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FRANCIS WHITTIER PENNELL

Associate Curator

(Nos. 211-216)

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JOURNAL

OF

The New York Botanical Garden

EDITOR

FRANCIS WHITTIER PENNELL

Associate Curator

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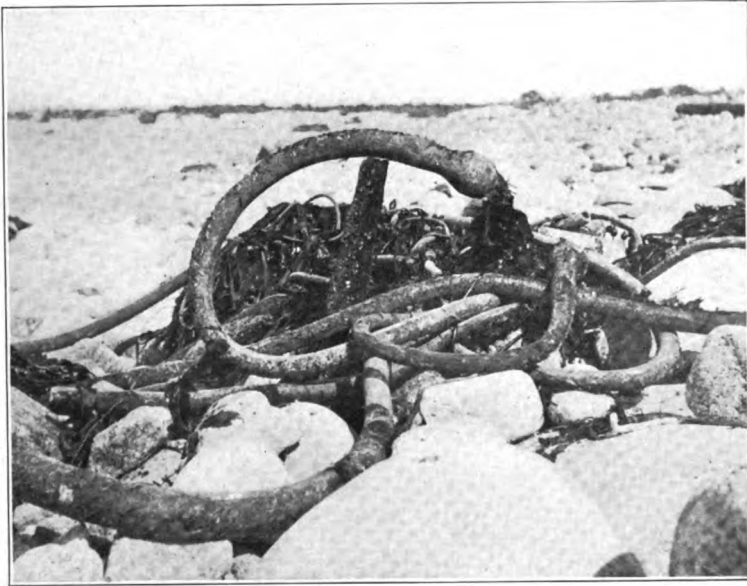


FIG. 1. *Nereocystis* washed up on the shore near Pacific Grove, California.
(Photograph from A. A. Heller.)



FIG. 2. "Seatron," a candied product, made from the stalks and vesicles of *Nereocystis* (a little more than one half natural size.) The basket is made from *Pelagophycus*.

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January, 1917

No. 205

SOME ECONOMIC USES AND POSSIBILITIES OF THE SEAWEEDS*

(WITH PLATES 189-190)

The seaweeds, or marine algae, as most of them are known to botanists, are more or less abundant in many parts of the world, but it is chiefly along rocky coasts of the temperate regions of both the northern and the southern hemispheres that they are sufficiently large and numerous to attract general attention. And it is only in such regions that they have been and are likely to be of some economic importance. In the vicinity of New York City the seaweeds are, as a rule, not particularly large or abundant, yet there are places, as at Pelham Bay and Hunter's Island, where the rocks and stones along the shore are left by the ebbing tide more or less densely covered with a coating of conspicuous algae belonging to the group commonly known as the rockweeds. Most of the sea plants grow either between the tide-lines or in water that is comparatively shallow, few of them being found attached to the bottom in water that is more than two hundred feet deep. As one goes northward along our Atlantic coast from New York, the seaweeds become more conspicuous and abundant, this abundance being especially pronounced in northern Massachusetts, the coast of Maine, the southern coasts of New Brunswick and Nova Scotia, and certain parts of Newfoundland. It is not everywhere along the seashore even in

[Journal for December (17: 209-246) was issued January 19, 1917]

* Abstracted and adapted from an illustrated lecture given at The New York Botanical Garden on September 25, 1915.

those regions that the algae occur in any obvious quantity. They are usually wanting on a loose sandy or muddy bottom, principally because they find little anchorage or foothold in such places. And there are localities where a wide-ranging and rapidly flowing tide seems to operate unfavorably on the marine vegetation. At Kingsport, Nova Scotia, for example, where the tide has a vertical range of nearly sixty feet, the marine flora is very poor, although wharves and rocks for its attachment are not altogether wanting.

In the writings of Horace, the old Latin poet, the phrase "vilior algâ" occurs, indicating that a seaweed was, even in his day, considered to be the climax of futility and worthlessness and that when one had said that anything or anybody was more worthless, useless, and cheap than a seaweed, one had gone about as far as the Latin language would carry one! And this idea has apparently persisted, more or less, in the popular mind at least, down to the present day, even though in some parts of the world it is well and generally understood that certain seaweeds serve very useful purposes. Although the seaweeds of the United States have not thus far been of much importance from the financial and economic point of view, it was quite otherwise a hundred years or more ago in Scotland, Ireland, and northern France, and is still quite otherwise today in Japan. In northern Scotland especially, and more particularly in the Orkney Islands and the Hebrides, the so-called kelp industry from about 1720 to 1830 was lucrative and important. The word "kelp" to a modern English-speaking botanist suggests in particular one of the larger seaweeds of the family Laminariaceae. But the word has had and still has a wider signification, meaning primarily some of the larger brownish or olive-green seaweeds and secondarily the ash derived from burning these seaweeds. This ash contains large quantities of "potash" and "soda", or potassium and sodium salts, and was for many years extensively used in manufacturing soap and glass and to a less extent is still so used in the British Isles. And until recent years this kelp ash has been the chief source of the iodine of commerce. The inhabitants of the Orkneys and the Hebrides, off the north coast of Scotland,

used to get a large part of their living from burning seaweeds and selling the ash. It is said that in the Hebrides a century ago the first toast to be drunk on festive occasions was "A high price to kelp and cattle." The general popular sentiment in favor of selling high and buying low was apparently as pronounced in the Hebrides a hundred years ago as it is in the United States today! In the height of the prosperity of the kelp industry, Scotland is said to have derived from it an annual income of about two million dollars. A certain Lord MacDonald alone is reputed to have made \$50,000 a year from the seaweeds that grew along the rocky shores of his land. The kelp industry was for many years an important one also in parts of England, Ireland, northern France, Norway, and Denmark. During the more prosperous period of this industry, the value of the seaweed crop on the coast of Brittany is said to have reached a million dollars a year. But after a time the soapmakers and glassmakers, or their collaborating chemists, found it cheaper to convert common salt into sodium carbonate, the potash salts began to come into the market from the natural deposits in the Stassfurt region of Germany, iodine was derived more cheaply from the saltpeter beds of Chile, and the kelp industries of northern and western Europe began to decline. However, the brown seaweeds are still gathered for their iodine on the coasts of Japan, Scotland, and Ireland, and kelp-burning remains an industry of some little importance in these countries. The species of *Laminaria* and *Ecklonia* (Japan) are particularly rich in iodine, though other members of the Laminariaceae and various rockweeds (species of *Fucus* and *Ascophyllum*) are sometimes included in the burning. In Ireland, according to Cotton,* "the 'rods' (stipes) of the various Laminariae employed are collected as they are cast ashore in autumn, winter, and spring, and placed on stone walls till burning time. In February and March the weed is also cut by hand during the lowest tides. . . . During the last weeks of June and in the beginning of July dense clouds of heavy oily smoke may be seen along the coast-line, and the preparation for this general burning provides employment for many months."

* Proc. Roy. Irish Acad. 31¹⁸: 152. 1912.

The use of seaweeds as a fertilizer for the soil has been in vogue for centuries among farmers living in the vicinity of the sea. In parts of the British Isles, France, Norway, and Denmark, in particular, the beneficial effects of the marine plants as a soil fertilizer have long been recognized. In northern France there used to be conflicts between those who wished to gather the seaweeds for fertilizer and those who wished to burn them for the ash—a matter that had to be regulated by laws. On the coast of Brittany in France and on the west coast of Ireland it is not unusual to see farmers and gardeners carting away seaweed from the shore to be used as a fertilizer for the land. It is used chiefly by the farmers living near the sea, though it is sometimes carted as much as seven or eight miles inland.* In Ireland, the weed is applied to potato beds previous to planting, and a dressing of seaweed is often applied in spring or autumn to grass lands and grain fields. In many places the loose seaweed that drifts in at certain seasons, especially during and after storms, is sufficient for the farmers' requirements; in other places, it is cut by hand from the rocks; and in a few localities in Ireland it is actually cultivated for use as a fertilizer. The *Fucus* farms of Achill Sound and Clew Bay have recently been described and illustrated by Cotton.† It seems that for this purpose places that are more or less level, sandy, and destitute of weeds are selected and that stones are planted out between the tide-lines for the seaweeds to grow on. The stones are set out in rows with paths between for convenience in harvesting and carting. The rockweed, here mostly of one species, appears of itself on these stones from the fertilized eggs or sporelings that are floating about in the water and finally attach themselves. The seaweed is cut in February and March when it is two years old and the stones are then turned over for another crop.

In the United States the practice of using seaweeds as a fertilizer for the soil is especially well established in Rhode Island, in which state the Agricultural Experiment Station has issued a

* Cotton, loc. cit. 153.

† Loc. cit. 53, 153. *pl. 5. f. 2.*

bulletin* on the subject. It would appear from this that in 1885 the value of the seaweeds used for agricultural fertilizers in Rhode Island was \$65,044, as compared with \$164,133 paid for commercial fertilizers. At Rye Beach, New Hampshire, the farmers attribute their unusual success with red clover to the fact that they cover the land with seaweed and plough it under, a practice that has obtained since the founding of the colony.†

The possibilities of an extensive and general use of certain seaweeds or their products as fertilizers for the soil in the United States have recently been emphasized by the appearance of two government publications bearing upon this matter. The first of these appeared in 1912 as Senate Document No. 190, with a prefatory message from the President of the United States and a letter of transmittal from the Secretary of Agriculture. This document is entitled "Fertilizer resources of the United States," and to the uninitiated it is not wholly obvious from the cover or title-page that the document has anything to do with plants that live in the sea, or, in fact, with any plants other than those ordinarily cultivated by the farmer. But, as a matter of fact, this report, or series of reports, embracing nearly 300 pages and numerous plates and maps, is devoted chiefly to seaweeds and more particularly to the larger seaweeds or kelps of our Pacific coast. The writers of this Senate Document, No. 190, seem convinced that the seaweeds, which have been so long neglected, in this country at least, are about to come into their own, in a rôle of much agricultural and economic importance.

The second of these government documents entitled "Potash from kelp" was issued in 1915 by the U. S. Department of Agriculture as Report No. 100. This sets forth the results of further surveys of the kelp beds of the United States, including Alaska, and reports progress in the mechanical problems connected with harvesting and drying the kelp.

The beneficial effects of seaweeds when applied to the soil were

* Wheeler, H. J., & Hartwell, B. L. Seaweeds. Their agricultural value, and the chemical composition of certain species. R. I. Agr. Exp. Sta. Bull. 21: 1-37. *f. 1-11.* 1893.

† Turrentine, J. W. The technology of the seaweed industry. In: Fertilizer resources of the United States. Senate Document, No. 190. 1912.

demonstrated by practical experience centuries before it was really understood just in what way the good effects were brought about. But it is now well established that their fertilizing qualities are due chiefly to the "potash" or potassium salts that they contain. Potassium, nitrogen, and phosphorus are elements that plants must find in the soil if they are to grow and thrive, and of these three essential elements the seaweeds supply potassium in special abundance. In addition to supplying potassium, the application of seaweeds in bulk appears to have a desirable physical effect upon the land. Most of the algae on being dried and then soaked out with fresh water swell enormously and when they are turned under by ploughing this quality is of advantage, especially on a light dry soil, as this sponge-like action of the seaweeds holds small reservoirs of water in close contact with the roots of the cultivated plants. The potash that has gone into the commercial fertilizers used by the farmers and gardeners of the United States has come almost wholly from the mines in the Stassfurt region of Germany, a region that represents a former sea-bottom where various soluble potassium salts have accumulated in a solid form by the concentration and final drying out of the sea-water. The Stassfurt mines up to the beginning of the present deplorable war have been the one important source of the potash supply of the world. Under the German conservation laws the amount of potash salts that may be mined each year has been limited and the proportion of the annual product that may be sold outside of Germany has also been limited and prescribed. The United States has supplies of phosphate rock sufficient for its own use and for export for centuries to come, but for potash the farmers of the United States have been almost wholly dependent upon Germany ever since they began to use artificial fertilizers. Previous to the great war, the United States was importing from Germany potash to the value of twelve millions of dollars or more annually. Three or four years before the war broke out there was some trouble between the American importers and the German "Kali Syndikat" over the raising of the price of potash and the threatened curtailment of the amount that was allowed to be shipped to the United States. This

incident, among other considerations, led the United States Congress to instruct the Bureau of Soils of the Department of Agriculture to investigate the possibilities of developing within the boundaries of the United States a supply of potash that would meet the domestic needs and thus make the United States independent of any foreign nation in this important matter. To many, it might not seem that all this had anything to do with seaweeds, but it turned out that it did. The first and most natural steps to discover sources of potash with commercial possibilities led in two directions, first to the alkaline basins of our arid West, especially where the surface alkali included potash salts, but this search has not thus far resulted in discovering any deposits of commercial importance, though borings at several points are still, I believe, being made by the Geological Survey. The second obvious trail led to the feldspar and granite rocks of the United States, which contain potassium in immense quantities, but in the form of insoluble compounds. It is quite possible to separate out this potassium and convert it into soluble compounds, but thus far the cost of doing it puts these rocks outside of the commercial possibilities as a source of potash for the gardener and farmer.

The Washington scientists, in looking about for an independent American source of potash, finally took into consideration the long-established use of seaweeds as fertilizers for the soil, and they began to investigate the extensive groves of kelps on our Pacific coast and to determine with some degree of accuracy the amount of potassium salts contained by them. One of the most important of these great kelps of the Pacific is *Nereocystis*, known also as the "bladder kelp," the "sea-otter's cabbage," the "bull kelp," and the "ribbon kelp." This kelp forms in places extensive groves or beds from Point Concepcion, near Santa Barbara, California, northward to the region of the Aleutian Islands of Alaska. The plant grows attached to the bottom in water that is from 10 to 100 feet deep and it thrives especially where there are strong currents of water or active wave movements. The plant has a long slender stalk, terminated above by a more or less globose hollow enlargement that is filled with air or gas, the chemical

composition of this gas varying according to the time of day, as has recently been shown. Several long blades or leaves spring from the top of this floating vesicle. Some rather large stories have been told about the length attained by this *Nereocystis*. Kjellman in "Die Natürlichen Pflanzenfamilien" of Engler & Prantl, apparently using figures given by an earlier writer, states that the plant gets to be 100 meters long, but several observers who have had unusually good opportunities for studying the plant have expressed the opinion that these figures have been exaggerated. Professor William A. Setchell has stated that the longest individual of this species seen by him spanned 41 of his paces, which, he says,* "fully equals that number of meters." This remarkable length was probably the result of a single season's growth, as, in most cases at least, *Nereocystis* appears to be an annual plant. This rapidly growing bladder kelp is, so far as abundance and massiveness are concerned, the most important seaweed from Puget Sound to the Aleutian Islands. The analyses made by the chemists of the Bureau of Soils in Washington show that from 27 to 35 per cent. of the dry weight of this particular kind of kelp consists of potassium chloride, which before the outbreak of the great war was worth \$40 a ton in the United States and since that time has greatly advanced in price.

Another large kelp of the Pacific coast that is rich in potash is *Pelagophycus*, the "elk kelp," the "sea pumpkin," or "sea orange," which is a close relative of the *Nereocystis*, but is more southern in its range, occurring from Point Concepcion, near Santa Barbara, southward to Lower California. There is apparently, however, not enough of this to make it of much potential importance as a source of potash. Small ornamental baskets made from its stalks and vesicles are sold as curios to tourists in San Diego and other southern Californian towns.

But the kelp of our western coast that from its general abundance and massiveness seems likely to be of the most importance as a source of potash is *Macrocystis*—known also as the "great kelp"—a name that it seems to deserve even when compared

* Bot. Gaz. 45: 126. 1908.

with other kelps of giant dimensions. This grows attached to the bottom in water that is mostly from 20 to 70 feet in average depth. It occurs in such large compact beds that it sometimes forms natural breakwaters for harbors, as at Santa Barbara. It impedes navigation with rowboats and, by becoming entangled with the propeller, sometimes even with steamboats. Stories of this plant's attaining a length of 700 feet or more have found a place in scientific literature, but the greatest length of a single plant so far as yet determined by actual measurement is, I believe, about 200 feet. The species persists through the winter and appears to be perennial in habit. It is abundant, locally at least, from Lower California to southern Alaska.

During the past four or five summers the Bureau of Soils has surveyed the kelp beds of California, Oregon, Washington, and Alaska, has published an extensive series of maps of these kelp beds in the two reports that have been mentioned, and has estimated the bulk of the gross material represented by these beds. Analyses of the principal kinds of western kelps from various localities have also been published, with special reference to their potash and iodine content. As a result of these surveys and analyses, the officials of the Bureau of Soils and of the Department of Agriculture are enthusiastic as to the future economic importance of our Pacific coast seaweeds. Dr. Frank K. Cameron of the Bureau of Soils states:*

"Assuming also that at least two crops a year of *Macrocystis* can be harvested on the California coast, we obtain as the totals about 390 square miles of kelp beds, producing annually 59,300,000 tons of fresh kelp, equivalent to 2,266,000 tons of potassium chloride. At the present time the total imports of potash salts of all kinds is about 1,000,000 tons, equivalent to about 400,000 tons of pure potassium chloride. That is to say, the giant kelps of the Pacific coast, harvested to a depth of 6 feet, could perennially yield an annual output of potassium chloride about six times the equivalent of the potassium salts now imported into the United States. It is hardly to be assumed that any such harvest of kelp is soon, if ultimately, to be realized; but it is practicable,

* Potash from kelp. U. S. Dept. Agr. Rep. 100: 30, 31. 1915.

and at least removes definitely any necessary dependence of the United States upon foreign sources of supply for potassium salts.

“It is also impracticable to give any close estimate of the value of the possible kelp harvest. Assuming that all the potassium chloride were extracted and marketed as such, the value at present prices would be approximately \$90,000,000, whereas if the crop were all reduced to dried kelp and sold at current figures for both potash and nitrogen content, the value would be in excess of \$150,000,000.”

This possible valuation of \$90,000,000 for the potassium chloride is evidently based upon its market price before the beginning of the war, *i. e.*, \$40 a ton. At the present time, what little potassium chloride is obtainable commands a price several times as great as this.

Mr. Milton Whitney, chief of the Bureau of Soils, in an earlier paper, adds: “Moreover, it should be perfectly feasible to cover most, if not the entire, cost of production of this vast ‘crop’ by the iodine and other by-products produced simultaneously.”

The mechanical difficulties connected with harvesting and drying the large kelps of our Pacific coast for subsequent use as a fertilizer seem on the point of being solved. The report on “Potash from kelp” includes description and photographs of a harvesting machine that has been in actual and successful operation near San Pedro, California. The machine has a toothed scythe-blade of the ordinary mowing-machine pattern that runs horizontally four feet below the surface of the water and there are also two shorter blades that run vertically at either side. The cut kelp falls on an endless belt, is brought over the side of the machine, and falls into a sort of hopper where it is cut into short lengths by another set of knives. There is then a conveying apparatus that brings the cut kelp to an open barge lying alongside and this barge is finally towed to the dock, where its load is discharged. A launch pushes the mowing machine through the kelp beds at the rate of about four miles an hour, and the machine is said to be able to cut twenty-five tons of fresh kelp an hour.

* Fertilizer resources of the United States. Senate Document 190: 7, 8. 1912.

Several companies have already been organized in California for harvesting kelp and making agricultural fertilizers from it. Some of the companies are using chemical processes for extracting the potassium chloride and iodine, while others are simply drying the kelp and using all of it for applying to the soil. In the latter case, the nitrogen as well as the potassium content is saved and used. It is said that the present unhappy demand for explosives has led an important company engaged in their manufacture to resort to the Californian kelps as a source of a part at least of its supply of potassium.

Various kinds of seaweeds are used as articles of food in different parts of the world, but it is only in Japan, China, and Hawaii that they form an important item in the diet of the people. In the United States, among the native-born population at least, the kind that is chiefly, though not very widely, used is the "Irish moss" or "carrageen" (*Chondrus crispus*), one of the "red seaweeds." On the coasts of Massachusetts (especially at Scituate) and New Hampshire, this "moss" is collected, dried, and shipped away in barrels, for making "sea-moss farina," puddings, blanc mange, or jellies. The final product is very palatable, especially when suitably flavored, and served with sugar and cream. It enjoys a certain amount of vogue with invalids as well as with others. This Irish moss was formerly used by the brewers in this country for clarifying beers, but I understand that they have now found substitutes for it and that consequently the Irish moss industry on the coast of New England is now less prosperous than formerly. The usual price has been 4-5½ cents a pound for the dried weed. For the year 1902, according to figures quoted by Smith,* the Irish moss gathered in New England amounted to 740,000 pounds, with a market value of \$33,300.

The dulse or dilsk (*Rhodymenia palmata*), another of the red seaweeds, may often be found in a rough-dried state in the waterfront markets of New York, Boston, and other seaboard cities of the United States. Those who like it commonly eat it raw

* Smith, Hugh M. The utilization of seaweeds in the United States. Bureau of Fisheries, Bull. 24: 169-181. 1904.

and dry as a sort of salad or relish. It is said that some of the Irish and Scotch were more addicted to chewing it in the older days before tobacco and chewing-gum became so common and popular. In Ireland and Scotland it is sometimes cooked. Certain Scotch gentlemen have been quoted* as saying that "a dish of dulse boiled in milk is the best of all vegetables."

Dr. T. C. Frye, professor of botany in the University of Washington, and C. E. Magnuson, of Seattle, hold a patent for the manufacture of an edible product, somewhat resembling candied fruit, from the stalks and vesicles of *Nereocystis*. This looks and tastes a little like preserved citron and the trade name for it is "seatron." The potassium chloride and other soluble salts are removed by treatment with fresh water, sugar is introduced in their stead, and flavoring extracts such as lemon, orange, etc., are added. The final result is really very toothsome and the first samples of it received for exhibition in a museum show-case of the New York Botanical Garden never reached any show-case! But it has not yet come before the public in any such conspicuous way as have certain other more recently invented and perhaps less meritorious foods. Although the so-called Irish moss is fairly well known as a food, the modern breakfast-food man and fancy dietetician have not thus far taken full advantage of the opportunities offered them by the plants of the sea. A writer in the New York Evening Post a few years ago remarked: "it is within the bounds of reasonable expectation that we shall soon see 'Shredded Seaweed,' 'Flaked Fucus,' 'Desiccated Dulse,' 'Predigested Sargassum,' 'Puffed Nereocystis,' 'Malto-kelp,' 'Cream of Sea-Moss' and a score more substitutes for hot cakes and maple syrup, done up in one-pound packages, 'guaranteed under the Pure Food laws,' and crammed down the throats of a long-suffering and surfeited people."

The Japanese make use of certain kinds of sea plants (*Gloiopeltis* sp.) as the source of a sort of glue that they call "funori." This is produced in Japan to the extent of two or three million pounds a year and is there rather extensively used in the manufacture of sizing for cloth. For this purpose it appears to have

* Smith, H. M. Loc. cit. 172.

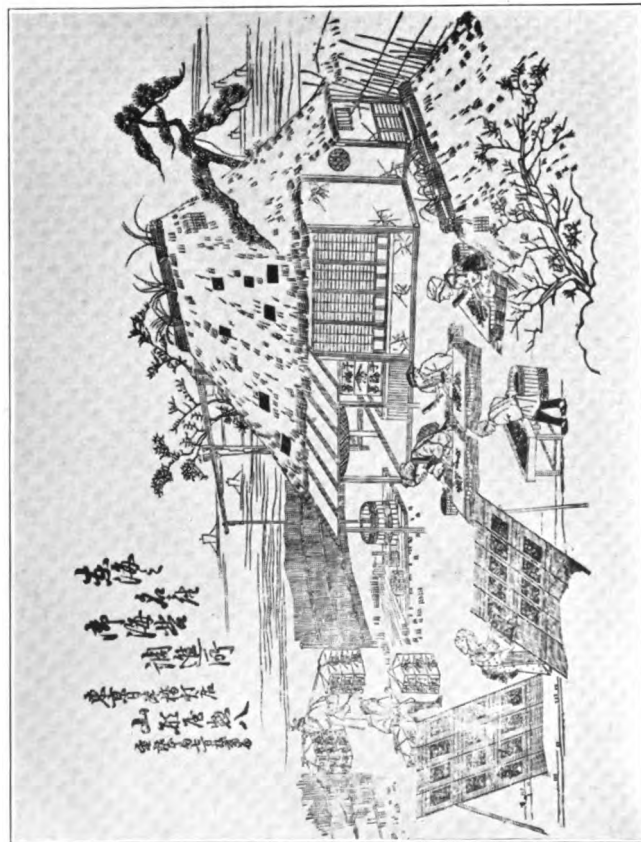


FIG. 1. Cleaning and drying *Porphyra* in Japan. From an old print said to have been used on a commercial wrapping paper by a Tokyo firm for 200 years. (After Yendo.)



FIG. 2. Bales of *Laminaria* ("kombu") for export from Japan to China. (After Yendo.)

certain advantages over starch. It is said to fill the cloth better, to be tougher, more elastic, transparent when dry, and not much affected by acids. It "imparts to the goods a thick clothly elastic feeling" without the stiffness that comes from the use of starch.

At the present day it is chiefly in Japan that the collecting and growing of seaweeds for food and for other purposes has attained the proportions of an important industry. One of the more important edible products of the Japanese algae is "kanten" or "Kant-Ten," which is derived from species of *Gelidium*, a genus of red algae that has representatives on the coast of the United States also. Dr. Hugh M. Smith* has estimated that the kanten prepared in Japan in 1902 probably reached 3,000,000 pounds, with a value of \$740,000. More than half of it is exported, going to China, British India, and, in small quantity, to the United States. In its manufactured form it is a white semi-transparent, tasteless, and odorless substance, and is sometimes known as "seaweed isinglass." It is used in Japan, China, and India as an ingredient of soups and sauces and is also served as a dessert and fashioned into a sort of candy. A part of the agar-agar of commerce, the glue-like or jelly-like substance that is so well known in American laboratories as a culture medium for bacteria and fungi, consists of this Japanese "kanten." The word "agar-agar," however, appears to be of Ceylonese origin, and the agar-agar of our laboratories originally came and still comes in part from the "Ceylon moss" of southern India, which seems to be chiefly *Gracilaria lichenoides*, belonging also to the red algae but representing a different family from the species of *Gelidium*. It is probable that still other sorts of seaweeds contribute to the making of agar-agar as sold in the markets of Europe and America, a circumstance that doubtless goes far to explain the somewhat varied and inconstant behavior of this substance as a culture medium.

Even exceeding "kanten" (*Gelidium* sp.) in importance as a food product in Japan is "kombu," which consists of various kinds of kelps, i. e., larger brown seaweeds, chiefly of the family Laminariaceae. The kelps of Japan are not so large as some of

* The seaweed industries of Japan. Bureau of Fisheries, Bull. 24: 133-165. pl. 1-4 + ff. 1904.

those of our Pacific coast, even though some of them are said to approach 100 feet in length. The gathering is done mostly in the late summer and in autumn and is done by men working from boats with hands, hooks, and dredges. The dried product is placed upon the market in various forms, raw or cooked, some of them being palatable and agreeable to foreigners, others not so much so. Smith* remarks that "Kombu enters into the dietary of every Japanese family, and is one of the standard foods of the country, the various preparations having different flavors and being used for different purposes." Most of these preparations are cooked with soup or are boiled and served with fish; some of them are used in the manufacture of confectionery. Large quantities of kombu are exported to China. The exports of kombu in 1901 are said to have amounted to 81,000,000 pounds, valued at \$774,000.†

Another type of seaweed that is of much importance as a food in Japan is found in one or more species of the genus *Porphyra*, which belongs with the red algae. This is known as "amanori," "Asakusa-nori;" or simply as "nori," which appears to be a general Japanese term for seaweed. "Laver" or "red laver" are English names for the same or closely related species. *Porphyra* is not only gathered from its natural haunts in Japan, but it has actually been cultivated for many years, especially in the region of Tokyo, and the cultivated crop is the present chief source of supply. Brush or twigs are set out in shallow water (preferably brackish) in protected places and in the winter the young *Porphyra* plants appear on these twigs, from which the mature plants are harvested from January to March. There are said to be more than 2,000 acres along the coast of Japan that are devoted to the cultivation of *Porphyra*. Girls and women do most of the work of collecting and drying the plant. *Porphyra*, served in various ways, is a prized article of food throughout Japan. Little is exported. In combination with soy beans, meat, or fish, it is made up into a sort of sandwich that is offered for sale at railway stations, street stands, etc. About one third of the dry weight of

* Loc. cit. 153.

† Smith, H. M. Loc. cit. 154. See also Yendo, K. Uses of marine algae in Japan. Postelsia 1: 3-16. 1901.

Porphyra is protein, so that it is a rich food, which apparently is more than can be said of most of the seaweeds. The *Porphyra* crop in Japan is worth about \$300,000 annually.

Several kinds of marine algae, other than those here mentioned, are used in Japan as articles of food. Statistics as to the less important kinds and also as to the kanten, kombu, and amanori consumed directly by the families of the fishermen and seaweed-gatherers are not obtainable. It is, however, surely no exaggeration to place the annual value of the seaweed crop as harvested in Japan at \$3,000,000. Nothing at all approaching this, in an economic way, has as yet been done with the seaweeds of the United States, but with the urgent demand for potash now arising from our farmers and gardeners, and with our usual sources of supply cut off by the war, it seems within the bounds of reasonable probability that the great kelps of our Pacific coast will soon yield even richer harvests than do the seaweeds of Japan.

MARSHALL A. HOWE

BIRDS IN THE NEW YORK BOTANICAL GARDEN

I

It was a mocking-bird that first attracted a number of bird observers to the New York Botanical Garden, and some of us have been regular in our visits there since. Where a "mocker" can live through half a dozen winters, there must be for birds plentiful food and reasonably good shelter.

Located at the northern boundary of the Carolinian zone, the Garden should share also in those other uncommon visitors from the Southland, the cardinal, Carolina wren, blue-gray gnat-catcher, and tufted titmouse. Except the last, all these have been seen. A pair of cardinals were seen frequently this summer near No. 2 greenhouse, and at least three of this species persisted for a while in the fringe of trees just north of the Museum.

To these trees during the past summer came also the orchard oriole. My Lord Baltimore, not uncommon here as in other

sections of the Garden, was more often to be seen in the willows of the north meadows. Cuckoos, mostly of the yellow-bill species, kept well to the high ground on the east side of the river among the low trees. Rose-breasted grosbeaks flamed forth in the river swamp above the Long Bridge, where also an occasional chewink would enliven the thicket.

Thrushes were most common in the enclosed portions at the north end of the Hemlock Forest, and surely its cool floor of dry needles afford the young birds a charming nursery. Veery and wood-thrush shared for nesting places the thickets around the lakes and seemed to get along very well together. Even if the former is occasionally aggressive in a determination to be sole lord of the manor, to the observer there was no evidence of jealousy. Later, when these birds were joined by their olive-clad and gray-cheeked brothers, together all took to the fruticetum where with cat-birds and robins they shared the abundant berries.

This brings us to the matter of food supply. Of this there is an abundance. Beginning with the oleasters in the northern end of the Garden down through the fruticetum walks lined with various dogwoods, viburnums, bush honeysuckles and scores of other shrubs and vines, there was never a day this summer and fall when birds feeding upon the fruits were not plentiful. An attempt will be made in a later article to give some idea of the various foods provided.

But in the matter of nesting places something is wanting, and should be supplied artificially. The Botanical Garden is spacious, sunny, shaded, protected from noise and traffic, and the public is rapidly discovering it. Of course Dr. Britton is pleased at this evidence of the people's appreciation, and is doing what he can to preserve and enhance this beautiful spot. While he need not interfere with the liberty of those who love to lie on the fresh grass and listen to the songs of birds, he should insist that at nesting time no one shall push his way through the thickets. Tube railings outlining the walks add to a well-kept appearance, furnish a seat for a moment's rest, and at least indicate preserves to those who are dull to understand the niceties of forest and field preservation. As a safety-valve, would it not be possible to

include some of the numerous inviting rocky hillsides in the part that is free to him who would "loaf and invite his soul"?

Perhaps the safest nesting place in the Garden is in the thorn trees. One year the nests here seemed to be mostly those of thrushes, and another year the catbirds held possession. You may easily reach these nests by thrusting your arm in among the branches; but as for withdrawing without scratches or a torn sleeve, that is a different matter, and the nest itself will be a sorry affair when you get it out.

Young cowbirds seemed to be common. Song sparrows fed them along the shore of the upper lake and up among the viburnums. A warbler built a second tier to her nest to cover up a cowbird's egg. There is some doubt as to the identity of this warbler. Young Kenneth Bull, the discoverer, thinks it was a pine warbler, but it is more likely to have been a chestnut-sided warbler. A relative, the yellow warbler, has been known to build four additions to its nest to get rid of a cowbird's eggs. The Maryland yellow-throats were likewise imposed upon, and played the baby-farmer act. With a river and several small lakes, naturally there are plenty of nests of yellow warblers and redwing blackbirds.

A redstart's nest attracted attention because it was so close to the walk at the end of the rubble-stone bridge, yet on Sundays hundreds of people have passed here without seeing it. It was less than the usual minimum five feet from the ground, but in all other respects was typical of the species. It was made of grass, vegetable fiber, plant-down, even bits of bark, and was lined with hair and grass. Some little girls, one a cripple, came every day for two weeks to watch over it, and brought bits of cotton; they stood or sat within a few feet of the nest, while the birds were building and feeding their young, and mounted guard over them on Saturdays and Sundays till the nestlings had flown away.

Phoebes nested on a beam of the shelter-house near the lake and under the rubble-stone bridge. A dozen oven-birds were seen nearby, and one nested near the Museum. A flock of 20-24 cedar-birds spent a good part of the winter in the Garden, and at least one pair remained till spring and probably nested on some of the apple-trees.

All our species of vireo were observed feeding in one tree, a horn-beam in the Herbaceous Garden, the seeds of which were equally favorites with myrtle warblers and sparrows. A red-eyed vireo nested close to the Long Bridge in the thicket of snow-balls at the eastern end.

The record for bird-nesting encouraged by man, comes from near Washington, fifty-nine pairs to an acre, but that included twenty-six pairs of martins, a bird not common nowadays in the city. It also included fourteen pairs of house-wrens. These are frequently seen in the big brush field of the north meadows and occasionally nest near the stable and propagating house. More of them could be induced to stay if boxes were provided with entrances too small for English sparrows. Bluebirds, flycatchers, and perhaps martins, would respond readily if encouraged with artificial nesting places. It is worth a trial.

F. F. H.

CONFERENCE NOTES FOR DECEMBER

The December conference of the Scientific Staff and Registered Students of the Garden was held in the laboratory of the museum building on Wednesday afternoon, December 6.

Dr. W. A. Murrill spoke of his explorations in the Catskills and Blue Ridge mountains during the past season, exhibiting specimens and illustrations of the more interesting fungi secured. A special feature of his work was a quantitative survey of both localities with reference to the larger fungi appearing during the time he visited them. This was made possible by the active coöperation of a large number of friends, who accompanied him daily on his botanical excursions. Accounts of these explorations have been published in the *Journal*, while lists of the fungi collected have appeared in *Mycologia*.

Dr. F. W. Pennell reported briefly on investigations of the Foxglove family in the Rocky Mountain states. This study is the outcome of a collecting trip in 1915 to Colorado, Wyoming, Utah and southeastern Idaho, since his return from which material in our own and most of the other leading American

herbaria has been examined. So far this review has considered the species of *Linaria*, *Collinsia*, *Scrophularia*, *Chionophila* and *Pentstemon*. In this region all but the last have but one species each, the last has over eighty. While the single species of *Scrophularia* and *Collinsia* are wide-ranging, nearly all the many species of *Pentstemon* are local, sometimes surprisingly so. Fortunately for the taxonomist, however, they are sharply defined, and show little hybridism. Such a genus as *Pentstemon*, breaking into clearly defined local species, should offer evidence of exceptional value for demarcating phytogeographic areas. The speaker has brought together records of localities with altitude and habitat, and by correlating these hopes to present statements of distribution much more natural than those current now.

Dr. N. L. Britton exhibited specimens from the beds of plant fossils recently found in Porto Rico, and made some comments on the significance of the discovery, these being the first Tertiary plant remains discovered in the West Indies; collections have been made by Dr. Chester A. Reeds and by Mr. Bela Hubbard.

A. B. STOUT,

Secretary of the Conference

NOTES, NEWS AND COMMENT

Dr. W. A. Murrill, Assistant Director, delivered an address on "Edible and Poisonous Mushrooms" before the New Brunswick [N. J.] Scientific Society on the evening of November 27.

Mr. Carl A. Schwarze of the New Jersey Experiment Station recently spent a day at the Garden in connection with his studies of the plant diseases of New Jersey.

Dr. J. N. Rose, Research Associate in the Carnegie Institution of Washington, who is coöperating with Dr. Britton in the preparation of an illustrated monograph of the cactus family, recently made a successful trip to the cactus regions of northern Venezuela, bringing back with him an illustrative collection of

living cacti, several of which were hitherto unrepresented in the Garden's collections, as well as many herbarium specimens. He also obtained a large collection of Venezuelan orchids, some of which have been retained at the Garden.

The following persons are among those who have registered in the library during November and early December: Dr. Mel T. Cook, New Brunswick, N. J.; Mrs. Nellie F. Flynn, Burlington, Vt.; Arthur Stanley Pease, Urbana, Ill.; E. V. Louth, Ashtabula, Ohio; Miss M. L. Merriman, Hunter College, New York; Dr. J. Arthur Harris, Cold Spring Harbor, L. I., N. Y.; Dr. C. F. Millsbaugh, Chicago, Ill.; Dr. Henri Hus, Ann Arbor, Mich.; Dr. Chester A. Darling, Meadville, Pa.; Professor William L. Bray, Syracuse, N. Y.

The Botanical Society of America held its annual meeting at Columbia University, December 26-30, 1916, in connection with the meetings of the American Association for the Advancement of Science and affiliated societies. The Garden staff was represented on the program by Dr. William A. Murrill, who gave an illustrated address on "The taxonomy of the Agaricaceae" at a joint session of the Botanical Society of America and the American Phytopathological Society; by Dr. Marshall A. Howe, who read a paper before the Botanical Society under the title of "A note on the structural dimorphism of sexual and tetrasporic plants of *Galaxaura obtusata*" and one before the Sullivant Moss Society under the title of "Notes on the North American species of Ricciaceae"; and by Dr. A. B. Stout, who presented a paper on "Fertility in *Cichorium Intybus*: Self-fertility and self-sterility in self-fertile and self-sterile lines of descent." The meetings of the Botanical Society of America were under the presidency of Professor R. A. Harper, one of the Scientific Directors of the Garden. The officers for the ensuing year include Professor F. C. Newcombe, University of Michigan, president; Dr. E. W. Olive, Brooklyn Botanic Garden, vice-president; Dr. E. W. Sinnott, Connecticut Agricultural College, treasurer. We learn from *Science* that there were presented in all 292 botanical papers.

During the convocation week of the American Association for the Advancement of Science many botanists visited the Garden. Among these were the following:

Professor Alexander W. Evans of Yale University was here on December 30 in connection with his studies of the genus *Herberta* of the Hepaticae.

Mr. F. S. Collins of North Eastham, Massachusetts, on December 30 consulted the library and examined the collections of algae.

Professor Ellsworth Bethel of Denver, Colorado, was at the Garden on the 27th. Professor Bethel is to be connected with the State Museum in Denver and spent considerable time looking over museum cases in order to get ideas to be incorporated into the Colorado museum.

Dr. George P. Clinton of the Connecticut Agricultural Experiment Station spent several days in the herbarium studying parasitic fungi on the leaves of gooseberries and currants.

Dr. J. J. Davis of the University of Wisconsin called and looked over the collections of parasitic fungi.

Professor J. H. Faull of the University of Toronto spent several days identifying his collections of fungi made in Canada.

Dr. F. D. Fromme of Virginia State College recently visited the mycological herbarium and looked over specimens of *Xylaria* in order to determine the identity of certain species causing root rot of apple trees in the South.

Professor J. B. S. Norton of the Maryland Agricultural Experiment Station spent some time looking over the genus *Mycosphaerella*, preparatory to a monograph of the genus.

Dr. L. O. Overholts of Pennsylvania State College spent several days studying some of the collections of higher fungi.

Professor H. H. Whetzel of Cornell University recently spent some time in the mycological herbarium looking over specimens of *Botrytris*.

Mr. F. Tracy Hubbard of Boston, Massachusetts, visited the herbarium to study our specimens of *Schizachyrium littorale*.

Dr. Karl M. Wiegand of Cornell University, Ithaca, New York spent a few hours here consulting types in the genus *Xanthium*, and also studying a little-known apparently introduced species of *Eragrostis*.

Mr. Donald White of the Massachusetts Agricultural College, Amherst, spent several days in the herbarium recording localities of grasses of the northeastern United States east of the Hudson River preliminary to field work planned to cover several seasons.

Others registered in the library were: Dr. J. H. Ehlers and Dr. C. H. Kauffman, Ann Arbor, Mich.; Dr. L. H. Pennington and H. P. Brown, Syracuse, N. Y.; Professor and Mrs. Aven Nelson, Laramie, Wyo.; R. J. Blair, Montreal, Can.; Dr. F. C. Gates, Carthage, Ill.; Dr. C. D. Howe, Toronto, Can.; Professor W. C. Coker, Chapel Hill, N. C.; C. E. Temple, College Park, Md.; H. E. Thomas and K. E. Quantz, Blacksburg, Va.; Professor Duncan S. Johnson, Baltimore, Md.; John N. Martin and L. W. Durrel, Ames, Iowa; Professor A. S. Hitchcock, J. B. Norton, W. F. Wight, W. D. Sterrett and William Palmer, Washington, D. C.; Ellsworth P. Killip and I. C. Jagger, Rochester, N. Y.; Dr. R. C. Benedict, Brooklyn, N. Y.; Professor W. W. Rowlee, E. E. Honey and Harvey E. Stork, Ithaca, N. Y.; Dr. W. D. Hoyt, Lexington, Va.

Dr. J. C. Arthur and Professor H. S. Jackson, of Lafayette, Indiana, have been granted research scholarships for the month of January. They will continue work on the plant rusts for *North American Flora*.

Volume 21, part 1, of *North American Flora*, by Paul C. Standley, containing descriptions of Chenopodiaceae, appeared November 27, 1910.

Volume 34, part 3, of *North American Flora*, by P. A. Rydberg, containing descriptions of Carduaceae: Tageteae and Anthemideae, appeared December 29, 1916.

A collection of the crude fibers of the Philippine Islands, presented to the Garden by Mr. Theodor Muller, has lately been installed in a case on the south wall of the west hall of the Economic Museum.

The Garden has recently received six large plants of *Livistona chinensis*, a gift from Mrs. F. S. Holbrook, The Uplands, Strawberry Hill, Stamford, Connecticut. These palms are about fifteen feet high and broad, and were sent by Mrs. Holbrook to the Garden on a large motor truck. This species is often known as *Latania borbonica*.

On the afternoon of December 7, ninety children of the 5B grade from Public School 10 of the Bronx came to the Garden for instruction in the classification of plants. They were divided into two groups, one in charge of Dr. M. A. Howe and the other in charge of Mr. Percy Wilson, and the special exhibits on the second floor of the museum building were used for demonstration.

Professor LeRoy Abrams, of Stanford University, has commenced the preparation of manuscript and drawings for an illustrated flora of the Pacific Coast, modeled after the "Illustrated Flora of the Northern States and Canada," published some years ago by Dr. Britton and the late Judge Addison Brown. This new flora will require four volumes instead of three, as in the case of its model, owing to the larger number of species to be included; the area of the new work will include all of California, Oregon and Washington, the coastal regions of British Columbia, and southern Alaska to about 60° north latitude; probably not fewer than 6,000 species of wild plants inhabit this large area. Dr. Britton will coöperate with Professor Abrams, and other members of the Garden staff will also give aid; it is anticipated that the herbarium of the Garden will be considerably increased in its representation of western species in the course of this investigation.

At the meeting of the Torrey Botanical Club held at the Garden, November 29th, Dr. Britton exhibited and remarked upon a very interesting collection of plants obtained by Mr. H. E. Winlock, of the Metropolitan Museum of Art, from a tomb at Luxor, Egypt. Mr. Winlock states that this tomb dates

from 1350 B. C. and that these plant specimens are of approximately that antiquity, thus about 3,266 years old. The specimens are in a remarkably perfect state of preservation, including leaves, stems, flowers, and fruits. Curiously woven garlands of olive leaves (*Olea europea*) are a feature of the collection; flowering heads of a species of *Centaurea* and berries of a species of *Solanum* are definitely identifiable. Portions of stems of a large grass are included, and there are fragments of other plants too incomplete for reference.

Meteorology for December.—The total precipitation for the month was 4.31 inches of which 1.57 inches (15.7 inches snow measurement) fell as snow. The maximum temperatures for each week were 62° on the 5th, 40° on the 13th, 42° on the 21st, and 40° on the 25th. The minimum temperatures were 31° on the 2d, 24° on the 11th, 14° on the 17th and 20th, and 17° on the 31st.

Meteorology for the year 1916.—The total precipitation at the New York Botanical Garden for the year 1916 was 31.05 inches. The distribution by months was as follows: January, 1.18; February, 3.74 (including 15.75 inches snow); March, 2.77 (including 22.5 inches snow); April, 2.62; May, 3.24; June, 4.05; July, 3.09; August, 1.21; September, 2.27; October, 0.87; November, 1.70; and December, 4.31 (including 15.7 inches snow).

The maximum temperature recorded for the year was 98° on the 22d of August. The minimum was 1° on the 14th and the 15th of February. The first killing frost of the autumn was on the morning of October 18.

ACCESSIONS

MUSEUMS AND HERBARIUM

325 specimens of flowering plants from Florida. (Purchased from Miss Janette P. Standley.)

3 specimens of flowering plants from New York. (Given by Mr. Percy Wilson.)

75 specimens of flowering plants from Delaware. (Collected by Dr. F. W. Pennell.)

82 specimens of ferns from various countries. (By exchange with the herbarium of Prince Roland Bonaparte.)

7 specimens of flowering plants from the District of Columbia. (Collected by Dr. F. W. Pennell.)

155 specimens of flowering plants from New York and New Jersey. (Given by Dr. L. H. Lighthipe.)

2 specimens of *Quamasia esculenta* from Michigan. (Given by Mr. O. A. Farwell.)

1425 specimens of flowering plants from Pennsylvania. (Collected by Dr. F. W. Pennell.)

279 specimens of flowering plants from Ulster, Green, and Dutchess counties, New York. (Collected by Mr. Percy Wilson.)

6 specimens of flowering plants from Pennsylvania. (Collected by Mr. W. H. Benner.)

33 specimens of grasses from New York. (Collected by Dr. Ralph R. Stewart.)

9700 specimens of flowering and flowerless plants from southern Florida. (Collected by Dr. J. K. Small.)

5 specimens of hepaticae from Maine. (By exchange with Miss Annie Lorenz.)

6 specimens of flowering plants from Long Island, New York. (Given by Dr. Roland M. Harper.)

70 specimens of flowering plants from Connecticut. (Collected by Dr. F. W. Pennell.)

50 specimens of fungi from Surinam. (Purchased from Mr. Jacob A. Samuels.)

3 specimens of fungi from Florida. (By exchange with Mr. Paul C. Standley.)

1 specimen of *Spongipellis galactinus* from New York. (Collected by Dr. W. A. Murrill.)

1 specimen of *Hypholoma aggregata* from New York. (By exchange with Mr. Hermann Kahle.)

1 specimen of *Lentinus strigosus* from Illinois. (By exchange with Dr. S. M. Stocker.)

1 specimen of fungus from Washington, D. C. (Given by Miss Harriet Daly.)

1 specimen of fungus from Arizona. (By exchange with Mr. W. H. Long.)

2 specimens of fungi from New Jersey. (By exchange with Mr. Edward F. Paddock.)

1 specimen of *Hypholoma Candolleianum* from New York. (Collected by Professor R. A. Harper.)

26 specimens of "Fungi Dakotenses," fascicle 16. (Distributed by Dr. J. F. Brenckle.)

2,306 specimens of flowering plants from New York. (Collected by Dr. F. W. Pennell.)

1 specimen of *Pentstemon* from District of Columbia. (Given by Dr. J. N. Rose.)

1 photograph of type of *Androsace asprella*. (Given by Mr. Harold St. John.)

15 specimens of flowering plants from Long Island, New York. (Given by Miss Mary E. Eaton.)

1 specimen of *Triosteum* from Connecticut. (Given by Miss Fannie M. Devan.)

2 specimens of fungi from Salt Lake County, Utah. (By exchange with Professor A. O. Garrett.)

2 specimens of fungi from Washington, D. C. (By exchange with General Timothy E. Wilcox.)

75 specimens of fungi from Virginia. (Collected by Dr. W. A. Murrill.)

2 specimens of fungi from Texas. (By exchange with Dr. J. J. Taubenhause.)

2 specimens of fungi from Chile. (By exchange with Dr. Carlos E. Porter.)

6 specimens of fungi from Cuba. (By exchange with Brother Leon.)

6 specimens of fungi from Rio Piedras, Porto Rico. (By exchange with Mr. J. A. Stevenson.)

73 specimens of fungi from western United States. (By exchange with Dr. J. R. Weir.)

10 specimens of fungi from Porto Rico. (By exchange with Mr. J. A. Stevenson.)

26 specimens of "Fungi Dakotenses," fascicle 17. (Distributed by Dr. J. F. Brenckle.)

2 specimens of *Mycosphaerella aurea* from Ontario. (Given by Mr. R. E. Stone.)

11 specimens of crude drugs. (Given by Dr. H. H. Rusby.)

1 specimen of *Noria* from Pennsylvania. (Given by Mr. Ambrose J. Heller.)

2 specimens of *Coleus* from Java. (Given by the Botanical Garden of Buitenzorg.)

5 specimens of flowering plants from Dutchess County, New York. (Given by Miss May K. Hoag.)

1 specimen of *Agarum cribrosum* from San Juan Island, Washington. (Given by Mr. Walter L. C. Muenscher.)

2 specimens of orchids from Pennsylvania. (Given by Miss Louisa M. Jacob.)

2 specimens of *Triosteum* from Long Island, New York. (Given by Mr. E. N. E. Klein.)

10 specimens of flowering plants from New Jersey. (Given by Mr. O. P. Medsger.)

2 specimens of *Solidago puberula* from Putnam County, New York. (Given by Mr. George V. Nash.)

1 specimen of *Glycine Apios* from Ohio. (Given by Mr. C. C. Pearl.)

1 specimen of *Chrysanthemum segetum* from the New York Botanical Garden. (Collected by Dr. A. B. Stout.)

1,055 specimens of flowering plants from New Jersey. (Collected by Dr. F. W. Pennell.)

7 photographs of types of calcareous algae in the John Ellis collection. (Given by the Royal College of Surgeons of England.)

PLANTS AND SEEDS

1 plant, *Cheilanthes* sp., for Conservatories. (Given by Mr. F. E. Lutz.)

2 plants, *Alstroemeria*, for Herbaceous Collections. (Given by Dr. H. H. Rusby.)

475 plants for forcing experiment. (Purchased.)

3 plants, *Ficus* sp., for Conservatories. (Given by Mr. A. Giamondi.)

1 plant, *Citrus Limonium*, for Conservatories. (Given by Mrs. Perina.)

6 plants of *Livistona chinensis*, for Conservatories. (Given by Mrs. F. S. Holbrook.)

1 plant, *Marsilea* sp. (By exchange with Prof. Ben Hill.)

- 2 plants, *Echinocereus Fendleri*. (Collected by Prof. A. O. Garrett.)
- 268 plants from Venezuela. (Collected by Dr. J. N. Rose.)
- 4 plants, all cacti, for Conservatories. (By exchange with U. S. Nat. Museum through Dr. J. N. Rose.)
- 20 bulbs of *Quamassia esculenta*, for Herbaceous Collections. (Given by Mr. O. A. Farwell.)
- 2,025 bulbs for decorative use. (Purchased.)
- 1 pkt. seeds of Indian plant. (Given by Prof. F. Boas.)
- 1 pkt. seeds of the Royal Poinciana, *Delonix regia*. (Given by Mr. Joseph Hertschuh.)
- 5 pkts. of seeds from Apple Orchard Mountain, Virginia. (Collected by Dr. W. A. Merrill.)
- 2 pkts. seeds. (Given by Dr. H. H. Rusby.)
- 17 pkts. seeds of California plants. (Purchased.)

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NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

JOURNAL

OF

The New York Botanical Garden

EDITOR

FRANCIS WHITTIER PENNELL

Associate Curator

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The Paulownia Tree at the Mansion.

JOURNAL

OF

The New York Botanical Garden

Vol. XVIII

February, 1917

No. 206

FURTHER DEVELOPMENT OF THE NEW YORK BOTANICAL GARDEN.

A

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL
GARDEN,

Gentlemen: The Executive Committee has considered the communication relative to the further development of the Garden submitted by the Director-in-Chief on November 16, 1916, and would report the following presentation of the subject with the recommendation that it be published and transmitted to all members of the Garden.

A. The City of New York has granted the Garden:

1. The use of nearly 400 acres of land in Bronx Park; the value of this land is not less than \$11,300,000
2. Funds which have been expended for buildings, driveways, bridges, fountains, paths, water-supply, drainage, and grading 1,400,000

B. The Garden's own activities have supplied:

1. Construction of paths, grading, water supply and minor construction, preparation of land for planting, furniture and equipment, costing about 150,000
2. About 14,000 species and varieties of living plants represented in the collections and valued at not less than 140,000
3. The library, containing about 28,000 volumes, valued at 112,000
4. Large collections in the public museums, valued at 50,000
5. The herbarium, consisting of about 1,500,000 specimens, valued at 150,000
6. Endowment and permanent funds aggregating 550,000

This represents property of a total value of about \$14,000,000

The contributions of the Garden to knowledge are noteworthy, and its publications are widely distributed. Many of its former students are occupying professorial and curatorial

[Journal for January (18: 1-27) was issued February 2, 1917.]

positions in institutions of learning. Through the teaching of children and the diffusion of information among adults, its direct educational work is continually expanding. Its collections are of very great scientific and educational value, are among the most important of any in the world, and have attained international significance. Its grounds are among the most beautiful and attractive of those of any public park.

To utilize properly this valuable property and to utilize as well our present efficient staff, more resources are urgently needed.

The completion of construction work during the next few years is much to be desired. This construction requires expenditure approximately as follows:

1. Completion of greenhouses. \$150,000
 Public Conservatory Range No. 2 is about one third built. The collections in both public ranges are crowded and greatly need more space. It is planned to make the central feature of Range No. 2 a display greenhouse for horticultural purposes. Space for the collections of economic plants is greatly desired.
 For experimental, cultural and student work, the propagating houses require additions.
 2. Completion of the Museum Building. 250,000
 The collections in the Museum Building are congested; they are continually increasing and becoming more complete and valuable; for their proper installation one of the two wings contemplated in the plans is required as soon as possible. More laboratory space is much needed for students, and more rooms for the preparation and storage of specimens. An additional lecture-room is needed and the library has outgrown its accommodations.
 3. Development of grounds and plantations. 100,000
 Only a beginning has been made in the development of the tract of about 140 acres added by the City in 1915 to the Garden reservation. Paths, drainage, water supply, grading and fencing are there required; also the preparation of ground for new plantations. Portions of the original area of 250 acres are also, as yet, undeveloped, needing grading, paths and planting.
-
- Total. \$500,000

Our present resources are insufficient to accomplish this work.

We might continue to spend about \$10,000 annually from our income as we have been doing for several years in developing the

grounds, but this is slow progress at the best and would not provide the needed buildings.

A gift of \$500,000, or gifts aggregating \$500,000, for expenditure would accomplish this work.

A gift of \$500,000, or gifts aggregating \$500,000, added to our present endowment, the interest only to be expended and the income made available for scientific and educational purposes subsequent to the completion of construction, together with such sums as might be added from other sources of income, would probably accomplish the work within about ten years. Such a foundation would be in many respects unique and its possibilities for usefulness would be enormous.

W. GILMAN THOMPSON, *Chairman*,
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B

The foregoing report was accepted and approved by the Board of Managers at a meeting held January 8, 1917, and was referred to the Endowment Committee with power.

THE PAULOWNIA TREE AT THE MANSION

(WITH PLATE 191)

The frontispiece to this issue shows a single large Paulownia tree which stands very near the Mansion in the New York Botanical Garden. This is one of several different kinds of ornamental trees used in the original scheme of decorative planting for the Mansion grounds.

This tree is about 62 years old, having been planted about 1857. When the photograph was taken last September, it

measured 14 feet in circumference, or over $4\frac{1}{2}$ feet in diameter, one yard from the ground; and it will be noticed that the trunk increases considerably at the base. It has long since passed its prime, but still flowers and fruits abundantly nearly every year. The position is a sheltered one and the soil good. An immense Norway spruce, which stood 30 feet to the south and was doubtless planted at the same time, had to be cut a few years ago because it was badly decayed. It showed 65 annual rings and was over 10 feet in circumference.

The Paulownia also, I regret to say, is visibly decayed at the base and that this decay extends throughout most of the trunk was shown the past summer by the appearance at a knothole far up in the center of the tree of a clustered fruit-body of the sulfur-colored polypore, which is a deadly enemy of trees, causing a heart-rot for which there is no remedy. It may be only a short time before this disease will cause the destruction of the tree.

The old tree would be missed by many of our visitors and its removal would be a positive calamity to the birds that build regularly in its branches and to the squirrels that use the cavities in the larger divisions of its trunk as winter residences. Last August, I discovered that it had attracted new tenants. A swarm of bees had located in one of the hollow branches 20 feet or more from the ground and were busy storing up food for the winter. Could this swarm have come from the large tulip-tree near the Long Bridge, where a nest of bees was discovered several years ago? It may be that the scouts sent out to locate the new home had visited the Paulownia when in flower and knew of its possibilities!

The botanical name of the Paulownia is *Paulownia tomentosa*, sometimes called *Paulownia imperialis*, and it is apparently the only arborescent representative of the figwort or foxglove family grown in North America. About eight species are recognized in the genus, all from China or Indo-China, but most of them are little known here and are probably less hardy than the common species. They are large or medium-sized trees with immense leaves and showy terminal panicles of purple or nearly white flowers resembling the foxglove in form. The genus was named

in honor of the ill-fated Anna Paulowna, daughter of the Emperor of Russia and hereditary princess of the Netherlands.

The *Paulownia* is called "Kiri" in Japan, where it is much cultivated, and "Too" or "Hak-too" in China, where it grows wild. In England and America it is often called Empress-tree. Dr. Siebold considered it one of the finest trees in Japan, and it has been admired there for centuries. The famous Japanese hero Taikasma designed his coat of arms from its flowers and leaves.

The occidental history of *Paulownia tomentosa* dates only from 1835, when it was grown from seed in the Jardin des Plantes in Paris. It was first cultivated in a greenhouse, but was later found to do better outside. The first tree grown fruited in its eighth year and later attained a diameter of over three feet, measured a yard from the ground.

In 1843, Paxton figured the tree in his *Magazine* and made the following statement regarding it: "A considerable quantity of this noble tree has lately been introduced to Britain from France and elsewhere; and the circulated accounts, with the likelihood of its proving hardy, have excited so much attention, that we are induced to publish a drawing of it, which was made for us last year in the Garden of Plants at Paris, even though the species has not yet flowered in our own country. . . . It is one of the finest of Dr. Siebold's many introductions from Japan, where it grows to the height of thirty to forty feet, with a trunk from two to three feet in diameter."

In *Curtis' Botanical Magazine* for 1852, a plate appears with the following comment: "We have at length the satisfaction of giving a figure of this noble plant, the first published from flowers produced in the open air in England." These flowers came from southern England; in London, the flower buds are often killed.

The *Paulownia* was probably introduced into America between 1842 and 1845 in the form of seeds, which were grown in some of the prominent nurseries. This nursery stock was doubtless distributed far and wide and gave rise to the first trees to produce and scatter seed in various parts of the country. It would be interesting to locate any of these original trees, and especially any that may still exist in the vicinity of New York City.

In the *Garden Journal* for 1907, Mr. Nash described and figured a young tree planted near the Museum building which grew fourteen feet in one season. Dr. Siebold said that his young trees grew six to ten feet in a year and increased their diameter four or five inches in three years. This rapid growth makes soft, light, coarse-grained wood of little strength but durable when not exposed to the weather and valued in Japan for cabinet work and for the charcoal used in the best fireworks.

A curious discovery was made in Paris in working with the first seedlings. During the first year, they made no wood and consequently died down to the ground, sending up one or two hardy sprouts the following spring with leaves nearer their adult form and structure. The tree has been spoken of as a "large herb," resembling as it does in some respects when young many of the large tropical herbaceous plants.

In America, the *Paulownia* has escaped from cultivation and grows wild from southern New York southward along the Atlantic and Gulf coasts to Florida and Texas. It is also a common tree in Indiana, California, and certain other states. North of New York City, the flower buds are usually killed during the winter, although the tree itself may be hardy as far north as Massachusetts. In Montreal, it is killed to the ground every year and new shoots spring up which are highly ornamental as foliage plants. Similar growths are sometimes secured farther south by cutting back the trunk regularly.

As in the case of the *Ailanthus*, the rapid spread of the *Paulownia* is due to its adaptation to almost any soil, its quick growth, easy propagation, and comparative freedom from diseases and pests. Great numbers of winged seeds sift through the slits in the ripe capsules and scatter in every direction. Shoots arise from the roots or from any part of the stem that may be covered with soil. Cuttings may be made not only from the root and green wood, but also from the young, unfolding leaves, thus emphasizing the peculiar herbaceous character of the tree.

As a shade tree, it may be used for parks, lawns, and avenues, but is hardly desirable for ordinary street planting. Light, deep loam is the best soil for it, although it grows fairly well in poorer

soils. The flowers are large, delicately scented, and attractively colored, but they appear before the leaves and thus lack a suitable setting. The conspicuous ovoid pods remain on the tree during the winter and give it an unattractive appearance. The terminal branches, also, exhausted by fruit bearing, usually die back three or four feet and have to be removed.

Two varieties of *Paulownia tomentosa* are recognized. Variety *pallida* has pale blue-violet flowers and leaves that are obscurely green above. Variety *lanata* has flowers of the typical color, but its branches, leaves, and flowers are conspicuously woolly-pubescent, which makes it somewhat hardier. It is also larger and better for cultivation than the ordinary typical form.

W. A. MURRILL,
Assistant Director

BIRDS IN THE NEW YORK BOTANICAL GARDEN

II. BIRD FOODS

To give a complete list of all the various kinds of food to be found in the Botanical Garden suitable for birds would be impossible in the space at our disposal. For convenience it has been thought best, following two recent and authoritative lists compiled by experts, to indicate which foods mentioned by them may be found in the Garden.

The following list of fruit-bearing trees, shrubs, vines and herbaceous plants attractive to birds, showing the season when the fruit matures and when it is available for food, is adapted from that compiled by Mr. Wilson H. Fay for Edward Howe Forbush's "Useful Birds and Their Protection." We cite only plants known to grow in the Garden.

June.....	Shad-bush, Juneberry, <i>Amelanchier canadensis</i> (tree).
June, July.....	Red-berried elder, <i>Sambucus racemosa</i> (shrub).
June, July.....	Wild red raspberry, <i>Rubus aculeatissimus</i> (shrub).
June, July, August.....	Blueberries, <i>Vaccinium</i> (shrubs).
June, July, August.....	Black and white mulberries, <i>Morus</i> (trees).
July.....	Wild strawberry, <i>Fragaria virginiana</i> (herb).
July.....	Thimbleberry, <i>Rubus occidentalis</i> (shrub).
July.....	Wild red cherry, <i>Prunus pennsylvanica</i> (tree).

- July.....Wild black currant, *Ribes floridum* (shrub).
 July, August.....Wild sarsaparilla, *Aralia nudicaulis* (herb).
 July, August.....False spikenard, *Vagnera racemosa* (herb).
 July, August.....Sassafras, *Sassafras variifolium* (tree).
 July, August.....High-bush blackberry, *Rubus allegheniensis* (shrub).
 August.....Black cherry, *Prunus serotina* (tree).
 August.....Choke cherry, *Prunus virginiana* (tree).
 August, September.....Gray cornel, *Cornus femina* (shrub).
 August, September.....Silky cornel, *Cornus Amomum* (shrub).
 August, September.....Red-osier dogwood, *Cornus stolonifera* (shrub).
 August, September.....Alternate-leaved cornel, *Cornus alternifolia* (shrub).
 August, September.....Beach plum, *Prunus maritima* (shrub).
 August, September.....Common elder, *Sambucus canadensis* (tree).
 August, September.....Dewberry, *Rubus villosus* (vine).
 August, September.....High blueberry, *Vaccinium corymbosum* (shrub).
 September.....Climbing bitter-sweet, *Celastrus scandens* (vine).
 September.....Moonseed, *Menispermum canadense* (vine).
 September.....Cranberry-tree, *Viburnum Opulus* (shrub).
 September.....Arrow-wood, *Viburnum acerifolium* (shrub).
 September.....Black haw, *Viburnum prunifolium* (shrub).
 September.....Withe-rod, *Viburnum cassinoides* (shrub).
 September.....Sweet gum, *Liquidamber Styraciflua* (tree).
 September, October.....White thorn, *Crataegus coccinea* (tree).
 September, October.....Tupelo, sour gum, *Nyssa sylvatica* (tree).
 September-October.....Northern fox grape, *Vitis labrusca* (vine).
 September-November.....Sheepberry, *Viburnum Lentago* (shrub).
 September-winter.....Flowering dogwood, *Cornus florida* (tree).
 September-winter.....Hackberry, nettle-tree, *Celtis occidentalis* (tree).
 September-winter.....Spice bush, *Benzoïn aestivale* (shrub).
 September-winter.....Snowberry, *Symphoricarpos racemosus* (shrub).
 September-winter.....Inkberry, *Ilex glabra* (shrub).
 September-winter.....Black alder, *Ilex verticillata* (shrub).
 September-winter.....American holly, *Ilex opaca* (tree).
 September, winter.....American mountain ash, *Sorbus americana* (tree).
 September-winter.....European mountain ash, *Sorbus Aucuparia* (tree).
 September-winter.....Red cedar or savin, *Juniperus virginiana* (tree).
 September-winter.....Common juniper, *Juniperus communis* (shrub).
 September-winter.....Poison ivy, *Rhus Toxicodendron* (shrubby vine).
 September-winter.....Checkerberry, *Gaultheria procumbens* (herb).
 September-winter.....Partridge berry, *Mitchella repens* (vine).
 September-winter.....Pokeweed, *Phytolacca decandra* (herb).
 September-winter.....Barberry, *Berberis vulgaris* (shrub).
 September-winter.....Common greenbrier, *Smilax rotundifolia* (vine).
 September-winter.....Bayberry, *Myrica carolinensis* (shrub).
 September-winter.....Privet or prim, *Ligustrum vulgare* (shrub).
 September-winter.....Virginia creeper, *Psedera quinquefolia* (vine).
 September-winter.....Common night-shade, *Solanum nigrum* (vine).
 September-winter.....American hornbeam, *Carpinus caroliniana* (tree).

- September–winter Cockspur thorn, *Crataegus Crus-galli* (tree).
 September–winter Wild rose, *Rosa humilis* (shrub).
 September–winter Staghorn sumach, *Rhus hirta* (shrub).
 September–winter Dwarf sumach, *Rhus copallina* (shrub).
 September–winter Smooth sumach, *Rhus glabra* (shrub).
 November Frost grape, chicken grape, *Vitis cordifolia* (vine).

Not included in the above list, but also in the Garden, are the following from a list compiled by Mr. William L. G. Edson for *Bird Lore*, December, 1915:

- June, July Ruprecht's Honeysuckle, *Lonicera Ruprechtiana*.
 July Morrow's honeysuckle, *Lonicera Morrowi*.
 July Bush honeysuckle, *Lonicera bella*.
 July Tartarian honeysuckle, *Lonicera tatarica*.
 September English Fly-honeysuckle, *Lonicera xylocsteum*.
 July Mahaleb cherry, *Prunus Mahaleb*.
 July, August White-fruited dogwood, *Cornus alba*.
 July Mountain currant, *Ribes alpinum*.
 July Buffalo currant, *Ribes aureum*.
 October Dogwood, *Cornus controversa*.
 August Purpus's dogwood, *Cornus Purpusii*.
 July Japanese oleaster, *Elaeagnus multiflorus*.
 July, August Smoke tree, *Rhus Cotinus*.
 July Japanese viburnum, *Viburnum tomentosum*.
 August Wayfaring tree, *Viburnum lantana*.
 August Arrow-wood, *Viburnum dentatum*.
 August Pubescent viburnum, *Viburnum pubescens*.
 September Canby's viburnum, *Viburnum Canbyi*.
 July European bird cherry, *Prunus Padus*.
 September Thorns, *Crataegus*.
 September, winter Buckthorn, *Rhamnus cathartica*, *lanceolata*, *Purshiana*.
 September Sea buckthorn, *Hippophae rhamnoides*.
 September, October Silver thorn or oleaster, *Elaeagnus angustifolius*.
 September to March Crab-apple, *Malus floribunda*.
 October Crab-apple, *Malus Ringo*.
 September Barberry, *Berberis Poirlettii*.
 September Common barberry, *Berberis vulgaris*.
 March, April Thunberg's barberry, *Berberis Thunbergii*.
 October Spindle-tree, *Euonymus Sieboldianus*.
 November Matrimony vine, *Lycium halimifolium*.
 Fall, winter Weigelia, *Diervilla hybrida* variety.
 Spring Dandelion, *Leontodon Taraxacum*.
 December Sweet birch, *Betula lenta*.
 August to March European white birch, *Betula alba*.
 August, September Black birch, *Betula nigra*.
 September to June European and Japanese larches, *Larix europaea*, *leptolepis*.

Fall, winter. St. John's wort, *Hypericum prolificum*.
 July. Goumie, *Elaeagnus longipes*.

"Nearly all the winter birds, from the kinglet to the crow, eat the barberry," says Mr. Forbush, who is State Ornithologist of Massachusetts. "The supply at Wareham usually becomes exhausted in February, after which the Myrtle warbler and many of the winter sparrows disappear." On the contrary, the barberry, which is prolific and of which several varieties are to be found in the Garden, does not seem to be a favorite with birds, although a few of them occasionally partake.

Robins feed on elder-berries, honeysuckles, dogwoods, mountain currant, oleaster, mountain ash, viburnums, sheep-berry, blueberries, hawthorn, buckthorn, crabapples, matrimony vine and barberries.

Bluebirds prefer wild cherries, sumachs, poke-berry and elder-berries.

Cuckoos like mulberries and elders.

Orioles choose mountain ash, wild cherries and service-berries.

Pine grosbeaks select poplars, pines, cedar, spruces, tamarack, maples and mountain ash.

Grackles favor elders and mountain ash.

Blueberries suit the chewink.

Cardinals partake of red cedar, catbrier; bittersweet, sumachs and haws.

Rose-breasted grosbeaks like buds and blossoms of all fruit trees and seed of alders and birches.

Thrushes eat small fruits and Virginia creeper.

Purple finch fares equally well on seeds of white ash or berries of red cedar and mountain ash.

Cedar waxwing visits dogwoods, oleaster, mountain ash, sheep-berry, blueberry, wild cherry, crabapple and of course cedar.

Of the vireos the yellow-throated prefers fruit of red cedar, and the red-eyed prefers prickly ash, dogwoods, sassafras, magnolias, hornbeam, spice-bush, mulberries, pokeberries and viburnums.

Even the woodpeckers spare time for a taste occasionally—the hairy of sumachs, Virginia creeper, and dogwoods; the downy of

sumachs and poison ivy; the red-head of mountain ash, acorns and beechnuts; the flickers of honeysuckles, dogwoods, bayberries, sumachs, and wild cherries.

The kingbirds find food on the dogwoods, and the phoebes on the hawthorns.

Look for crossbills where you find arbor-vitae, tamarack or firs; redpolls on birches, alders, buttonbush or larches; siskins on sweet gum, maples or elms; gold-finches on smoke-tree, birches or larches.

Thrashers visit viburnums, mountain ash, honeysuckles, dogwoods, currants and cherries.

Tennessee, black-throated, green and myrtle warblers are fond of poison sumach and ivy.

St. John's-wort is a favorite with junco and tree sparrow.

Catbirds eat dogwoods, oleaster, viburnums, Virginia creeper, sassafras, spice-bush, honeysuckles, cornels and blueberries.

F. A. H.

NOTES FROM THE HERBACEOUS COLLECTIONS—I

Plants of a possible horticultural value or of especial botanical interest are grown in the Herbaceous Grounds. It is planned to present from time to time notes concerning these. In this number are considered four plants of the Poppy family, all of which have flowered during the past summer.

Hypocoum procumbens L. is a delicate annual which flowered for a short time in mid-summer. While it promises little of horticultural value, it proves of interest from a botanical standpoint. Several stems less than 1 foot high rise from amongst leaves slightly glaucous, resembling those of the fumitories. Lightly carried on the stems are bright yellow flowers each less than 1 inch in diameter. The two sepals drop when the flower expands, and the four petals also fall after a short time. Of the latter the two outer ones are ovate and bluntly three-lobed, the two inner are much smaller, and nearly trifid. This is, perhaps, the most striking irregularity of corolla in the Papaveraceae. The long slender capsule is transversely ridged, and at first glance suggests that of some member of the Mustard family.

This plant, which is a native of parts of Europe, Asia, and northern Africa, is said to sow itself freely in England, being treated as a hardy annual. In conditions such as those given it at the Garden, it needs to be grown each year from planted seed, preferably in its permanent location.

Another interesting plant is the yellow or Celandine poppy, *Stylophorum diphyllum* (Michx.) Nutt., an herb of use to the horticulturist. It is the American representative of a small genus, of which another species is in our herbarium from China. It is a robust perennial, with leafy stalks, 1 foot high, arising from a large rootstock. The leaves are ovate-oblong, varying from bluntly lobed to nearly crenate-margined. They are slightly glaucous above and almost scurfy beneath. Two small stem-leaves are usually borne together at the top of the stem, hence the specific name. Above these two leaves are the blossoms in a few-flowered terminal raceme. The hairy sepals drop away when they are no longer needed to enclose the folded flower, and disclose a corolla 2 inches in diameter, made up of four rounded yellow petals. The center of the flower is made prominent by the large green style and stigma with the yellow anthers as body-guard. The capsule is four-valved, oval, and tipped with the persistent style.

In the presence of a copious orange-yellow sap, and in the appearance of its leaves, the Celandine poppy resembles that old favorite, the Celandine, but has flowers much larger and capsules distinct in size and shape.

Stylophorum diphyllum is native to the east-central United States, where it grows in low, moist woods. Our plant flourishes in the open, doing much better for us there than does its relative the blood-root. It is very floriferous, blooming in the spring and early summer, and is quite hardy. A somewhat shaded location may improve it. Easily grown from seed, it may also be propagated by dividing the roots. However, this should be attempted with the care needed in the treatment of plants of the poppy and fumitory families.

During the summer of 1915, in the nursery of the Garden, a group of scurfy gray leaves appeared to be the only manifestation

of a plant designated as a *Glaucium*. The following year, however, a strong branching stem grew to a height of nearly 3 feet, bearing rounder, smoother and clasping leaves, which were quite different from the radical ones below. This stem bore several large yellow flowers of short duration, but which were quickly followed by others. The capsules were long, slender, and slightly curled, with a dryness and brittleness which gave them an appearance of being carved out of some light wood.

This plant, the yellow-horned or sea poppy (*Glaucium Glaucium* (L.) Karst.), is a native of Europe, but is now found adventive in parts of the eastern United States. On account of its silvery-gray root-leaves, it may be used as a foliage plant; however, its coarse habit makes it of little value for the flower garden. It appears to be biennial here, and is easily propagated by seeds sown directly in the permanent location.

After a complete failure one season, the cream-cups, *Platystemon californicus* Benth., has been grown in the Herbaceous Grounds this summer. This species is a dainty annual from the Pacific slope of this country. In habit it is low and branching, and is clothed with an abundance of long spreading hairs. The leaves are linear-lanceolate and entire. The flowers are borne on slender pedicels 4 to 5 inches long. The sepals are three in number, one more than most of the plants of the order possess. The six cream-colored petals remain expanded longer than do those of the other genera of the family, but our specimen did not show the corolla persistent over the capsule, an interesting habit claimed for *Platystemon*. This name, which is Greek for "broad stamen," is derived from the dilatation of the filaments of the cluster of stamens which surround the style. The capsule is divided to the base into moniliform carpels, a very singular character which has suggested to botanists a kinship to the Crow-foot Family.

This plant is native to California, Utah, and Arizona, living in sandy soil. It is occasionally grown as a border annual, and is to be propagated by seeds sown in the open ground.

The *Eschscholtzias*, *Hunnemannias* and *Argemones*, more familiar members of the poppy family, by reason of the beauty

and oddity of their leaves and the varied yellow shades of their flowers, furnish us with plants so attractive that these others of their clan may seem scarcely needed in our gardens. However, these others show no lack of interesting characters, and it is to be hoped that they may be kept in our collections.

KENNETH R. BOYNTON

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R. S. WILLIAMS

NOTES, NEWS AND COMMENT

Professor F. D. Kern, of the Pennsylvania State College, recently spent several days at the Garden working over manuscript on rusts preparatory to the work in *North American Flora*.

Dr. O. Kunkel, of the United States Department of Agriculture, recently spent a day at the Garden conferring with Dr. Arthur in connection with rust work.

Dr. W. C. Sturgis, formerly Dean of the College of Forestry in Colorado College, was a recent visitor at the Garden. Dr. Sturgis expects to spend several weeks in Bermuda where he will collect fungi and slime moulds.

Dr. Henri Hus, who is on leave of absence for three years from the University of Michigan, is spending several months at the Garden prosecuting investigations of various rubber-producing plants. He has recently returned from Java, with considerable material for his studies.

The following persons enrolled in the library during January as visitors to the Garden: Dr. C. H. Kauffman, Ann Arbor, Mich.; Dr. Caroline A. Black, Durham, N. H.; Dr. A. G. Johnson, Madison, Wis.; Dr. H. B. Humphrey, Washington, D. C.; Dr. J. C. Arthur and Prof. H. S. Jackson, Lafayette, Ind.; Dr. D. T. MacDougal, Tucson, Ariz.; Dr. E. E. Free, Baltimore, Md.; Dr. Alfred Gunderson, Brooklyn, N. Y.; Dr. H. Hus, Ann Arbor, Mich.; Dr. Philip Dowell, Port Richmond, N. Y.; Prof. Frank D. Kern, State College, Pa.; Miss Caroline C. Haynes, Highlands, N. J.; Dr. Ezra Brainerd, Middlebury, Vt.; Dr. Wm. C. Sturgis, Colorado Springs, Colo. and Prof. Alexander W. Evans, New Haven, Conn.

Dr. C. L. Shear visited the Garden on February 3 to consult the library and mycological collection. He then went with Professor J. C. Arthur to Philadelphia to examine the Schweinitz collection of fungi to determine how it may be made more available to American mycologists. Dr. Shear and Dr. Arthur are members of a committee appointed for this purpose by the American Pathological Society.

Dr. W. A. Murrill, assistant director, visited the state museum at Albany, January 12-16, to study certain types of fleshy fungi described by Dr. C. H. Peck. The herbarium is now safely housed in new steel cases in the Education Building, and most of the types appear to be in excellent condition. Dr. H. D. House, state botanist, has spent considerable time getting the specimens of fungi together so that they might be available for study.

Dr. Marshall A. Howe, curator, gave an illustrated lecture on "Planning Next Summer's Flower Garden" before the Garden Club of Pleasantville, New York, on the evening of February 6.

The second lecture and conference of the course for Garden members being given at the Mansion was delivered on Thursday, February 8. The subject was "Winter Fruits" and was presented by Mr. George V. Nash, head gardener. A collection of specimens from the Garden collections of about thirty kinds of shrubs and trees, still retaining their fruits, was exhibited. About two dozen colored drawings of shrubs and trees in fruit were also displayed; these drawings were prepared for future illustrations in "Addisonia."

Nearly 700 biology pupils from Evander Childs High School spent the forenoon of January 23 at the Garden studying the conservatory and museum collections under the guidance of their teachers and members of the Garden staff, following a schedule and series of exercises prepared by Mr. Paul B. Mann. The subject of forestry was presented by an illustrated lecture given in the lecture hall by Mr. George E. Hewitt. In connection with this subject, various trees on the grounds were examined with special reference to their appearance and protection during the winter months.

About 600 biology pupils from Morris High School assembled in the lecture hall of the museum building shortly after eight o'clock on the morning of January 25 to hear a lecture on forestry by Mr. Sherwood, of the American Museum of Natural History. After the lecture, the pupils in groups of fifty were conducted through the museum to observe plant products; through the grounds to examine trees in winter condition; and through the conservatories to see tropical economic plants. A list of carefully prepared questions was submitted to each pupil to be answered in writing while making the observations.

An attractive place in conservatory range 1 during this month is the aquatic house, no. 9. Here are two tender water-lilies,

Mrs. Woodrow Wilson, of a rather pale blue, and Panama-Pacific, of a deep rosy red when first opening, later becoming a rich reddish purple, one of the recent and most attractive of the tender water lilies. Another interesting plant in this house, a native of the swamps of the eastern United States, is the golden club, *Orontium aquaticum*; the golden spikes, on erect ivory-white stalks, are in striking contrast with the rich dark green of the foliage. Many other interesting plants will be found here, both in the water and planted along the margin of the pool.

Meteorology for January.—The total precipitation for the month was 3.30 inches, of which 0.9 inches (9 inches snow measurement) fell as snow.

The maximum temperatures for each week were 51° on the 7th, 48° on the 10th, 41° on the 18th, and 49° on the 28th. The minimum temperatures were 21° on the 7th, 7° on the 12th, 17° on the 20th, and 13° on the 27th.

ACCESSIONS

PLANTS AND SEEDS.

- 3 plants, all cacti, for conservatories. (Collected by Dr. J. K. Small.)
- 1 plant of *Mamillaria radiosa*. (By exchange with U. S. Dept. of Agriculture, through Mr. H. W. Long.)
- 4,000 bulbs of Darwin tulip Margaret. (Given by John Scheepers & Co., Inc.)
- 5,000 bulbs for decorative purposes. (Purchased.)
- 1 pkt. of seed of *Ardisia polycephala*. (Collected by Dr. J. K. Small.)
- 1 pkt. of seeds of *Ipomoea triloba*. (Collected by Dr. J. K. Small.)
- 4 pkts. of seeds of Australian shrubs. (Given by Mr. Henry Natho.)

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FRANCIS WHITTIER PENNELL

Associate Curator



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Phlox subulata on serpentine barrens near Lima, Pennsylvania, May 9, 1914.



Near view of *Phlox subulata* showing general character of flowers. Plants of *Cerastium velutinum* intermingled. Above photos by courtesy of Wm. R. Taylor.

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VARIATION IN THE MOSS PINK, PHLOX SUBULATA

(WITH PLATE 193)

The ground or moss pink has long been recognized as a species that is variable in its natural habitat. The most noticeable variations pertain to the color of the flowers and to the shape and size of the corolla-lobes; these are indicated in the standard taxonomic treatments of the species by such descriptions as the following: "corolla pink, purple or white, with a darker eye, its lobes emarginate or entire."*

Such polymorphism is, of course, not uncommon in rather well-defined species. In some species, as for example of the violets and of the hawthorns, the very marked and rather indiscriminate variation makes the identification of species rather difficult. Usually such variability is more or less geographic with an isolation of different types in different areas of the range of distribution, the facts of which can only be determined by extensive field observations by one person or by a coordination of the observations and collections of numerous persons. Very often, however, it happens that the individuals of a species growing in a rather limited area exhibit a very decided variability that is equal, or nearly equal, to that for the species throughout its range. It appears that there are localities where this is the case with *Phlox subulata*.

This species is not of cosmopolitan or general distribution

* Britton, N. L., and Brown, Addison. Illustrated Flora of the Northern United States, ed. 2. 3: 57. 1913.

[Journal for March (18: 53-74) was issued April 13, 1917.]

throughout its range. It seems, rather, to be restricted to somewhat isolated localities where it thrives in such great abundance that it forms a dense mat of vegetation, which though less than a foot in height decidedly dominates the habitat. Some conception of this can be gained from the photographs reproduced in the accompanying plate. On account of the perennial habit and its evergreen nature, such a growth is noticeable throughout the year. When the plants are in full bloom the profusion of flowers gives a veritable sea of color all the more conspicuous because the species grows best on dry rocky hills or banks where the nature of the terrain affords a rather wide outlook.

These conditions are well exemplified by the development of this species along Johnson's Creek just outside the city limits of New Brunswick, New Jersey. For a distance of about a mile along the sandy and rocky banks and upper slopes bordering this creek there is a luxuriant growth of the "moss pink." A line of the Pennsylvania Railroad passes through the area, and when the flowers are in evidence many a traveler is surprised at the extensive views that are solid with red color. Along Bound Brook, some miles distant from New Brunswick, this species is also rather abundant, but there the plants are somewhat more scattered and less numerous than along Johnson's Creek.

Perhaps the best development that is to be found throughout the range of this species is to be seen on what is known as the Serpentine Barrens of Unionville, Chester County, Pennsylvania. There the species covers about one hundred contiguous acres with a dense mat growth. It is difficult to conceive of a more dominating or a more vigorous growth of this species. There may be areas of larger extent, but it is doubtful if the development is ever more luxuriant per unit of area. When covered with the full bloom of the flowers, the general red hues of the hills are visible for a distance of several miles.

The writer visited this locality on May 8, 1916, in the company of Dr. F. W. Pennell and Mr. James R. Pennell. It was an ideal May day and the phlox was in full bloom with a brilliance

of color that defies description. A general survey was made of the variations, and living plants representative of the various forms observed were taken and later planted in the experimental plots at the New York Botanical Garden for use in breeding and in propagation. The following description of these on the basis of flower color will give some idea of the wide extremes of variability observed and of the almost endless gradations that exist between the extremes.

The descriptions were made from fresh and fully developed flowers and the terminology used in reference to colors is that of Ridgway's Color Standards and Nomenclature.

It may be noted that the corolla of this species is salverform with the expanded portion cut into lobes quite as in the familiar garden varieties of phlox. The three parts of the corolla especially to be noted in the descriptions are the tube, the expanded blades or corolla-lobes, and an eye area in the base of the lobes just outside the throat. No attempt has been made to give varietal terminology: the various forms have simply been given numbers and have been grouped according to the prevailing colors.

I. GROUP WITH FLOWERS WHITE OR PREVAILINGLY WHITE

1. Pure white corolla with no trace of color in tube, blades or eye area.
2. Completely white in blades and in eye; pale and faint pink in tube.

II. GROUP WITH FLOWERS PREVAILINGLY OF PINK SHADES

3. Rather diffuse pale amaranth pink in blades; slightly more intense in eye with faint suggestion of eye spots; tube less intense.
4. Paler than no. 3 in blades; faint but decided pair of spots in eye area at base of each blade; tube more deeply colored than blades and of a pale amaranth tint.
5. Blades white; two large pale bluish violet eye spots at base of each blade; tube pale bluish violet.
6. Blades white; intense almost amethyst violet eye spots (two for each blade); tube diffuse pale violet.

7. Blades pale amaranth pink as in no. 3, but with two decided eye spots of Tyrian pink in each blade; tube almost white.

8. Blades pale amaranth pink; eye spots decided and of amaranth purple; tube darker than blade.

9. Blades pale amaranth pink; eye spots amaranth purple joining to form a rather broad band or eye ring; tube darker than blade.

10. Blades pale amaranth pink; eye spots and tube intermediate between those of nos. 7 and 8.

11. Blades and tube light mallow purple; eye spots two for each blade, their margins joining to form a ring darker in color than that of no. 9.

12. Blades pale mauve; tube darker; eye spots small but very definite and manganese violet.

13. Darker than no. 21; eye spots of same color as in no. 12, but blending in a ring.

14. Blades and tube as in no. 13; eye as in no. 12.

III. GROUP WITH FLOWER COLORS OF LAVENDER TINTS

15. Blades and tube mauvette; eye spots small but decided and of Mathew's purple.

16. Intermediate between nos. 15 and 17.

17. Blades and tube light phlox violet; eye spots pansy violet with rather indistinct borders.

18. Color of blades and tube as in no. 17; eye spots of same color, but more distinct and much more elongated into blade.

19. Colors as in no. 17; eye spots more distinct and broader (eye spots in no. 18 are long and narrow, these are short and broad).

20. Blades and tube deep pink lilac; darker colored eye spots elongated into blades, but with bases run together in an eye ring.

IV. GROUP WITH FLOWER COLORS OF PURPLE TINTS

21. General color mallow purple; the more darkly colored eye spots small and the two for each blade somewhat run together.

22. Colors darker throughout than no. 21.

23. General colors as in 21, but eye spots broken into fine lines.

24. General color Liseran purple; small eye spots of darker shade.

25. Blades and tube magenta; eye spots of darker shade, small and very definite.

26. Colors intermediate between nos. 24 and 25.

27. Blades dull magenta purple; tubes of darker shade; eye spots of darker color than blades, broad and run together.

28. Blades and tube Schoenfeld's purple; an eye ring of pansy purple, the two eye spots in each blade indicated in the ring.

29. Blades and tube Rosaline purple; eye spots rather faintly defined.

The above list does not exhaust the possibilities of classification of the color variations. It only recognizes the most conspicuous and the most distinct variations that were seen during a few hours of observation in the field.

Neither is the grouping to be considered as fully adequate. The colors predominating in the forms listed before no. 14 are pink; in forms from 15 to 20 the lavender or lilac tints prevail, and from 21 to 29 inclusive the colors are of a purple series and are the darkest of all. The extremes are very decided: no. 1 is a pure white, nos. 13 and 10 are the darkest of the pink group; no. 20 is the form with strongest development of lilac tints; no. 25 is a full magenta, and no. 29 is the darkest of the purple tints. Within each group the forms are in general graded according to intensity of coloration, the paler tints being given the lower numbers. Perhaps some of the paler tints classed with the pink group could as well be placed with the palest of the lavender or the purple group. Although the extreme types are very distinct, there is almost every conceivable variation between them.

A rather marked feature of the coloration is the quite general intensification of color in two rather limited areas near the base of each corolla-blade forming the eye spots. Often, as noted in the above descriptions, there were shades rather distinct from the general colors of the blades. Even in no. 6, with blades lacking in color, the eye spots were of intense coloration. The size, shape and configuration of the eye spots also varied much.

It was very noticeable that all the flowers of a plant were remarkably uniform in respect to coloration and to the rather minute differences that often marked it from other plants around it.

It may be noted that in the development of eye spots, the localization and intensification of pigments in a particular area or zone produces color patterns instead of solid colors. Such results illustrate excellently how the production and flow of substances concerned with the production of pigments may act in the development of such many-celled organs as leaves and petals.

It would be rather difficult to estimate which of the various forms described is most abundant. The pure white-flowered form is conspicuous and readily identified, and plants of this form were quite frequently seen; they were scattered rather promiscuously over the area, but constituted only a small proportion of the total population. Representatives of pink, lavender and purple-colored forms were seemingly nearly equal in number and were very generally mixed together throughout the entire area.

In respect to a color analysis, the variations involve only blue and red of the primary colors. The pink colors are red, diluted: the lavender and lilac are blue and red with less in proportion of the red; and the purple series are blue and red in nearly equal amounts. A simple dilution, of course, gives endless gradation of intensity. There is no suggestion of yellow pigments in any of the combinations. This is, perhaps, indicative that the actual chemical substances involved in the production of the various shades of color are few and that the variations are due to a series of quantitative differences in the production of the fundamental chemical substances that are interacting.

There also were very noticeable variations in the size of the flowers borne by different plants, the largest being about twice as large in the diameter of the open corolla as the smallest. The shape of the corolla-lobes varied greatly; one extreme had rounded and overlapping lobes, while the opposite extreme had narrow and widely separated lobes. Another very decided variation in shape was seen in the character of the apex of the lobes,

which ranged from fully rounded to truncate and to deeply notched. The unnotched lobes were either flat, smooth, or very much crumpled, fluted or ruffled. With respect to these characters of size and shape, many forms could be described, any one of which would include plants of widely different types in respect to color.

Considerable difference was observed in the general habit of growth; some plants were more erect than others; some were more branched, some were more leafy, etc. Also, in size of leaves and degree of hairiness, various plants differed greatly.

Through the kind courtesy of Dr. and Mrs. A. L. Smith of New Brunswick, New Jersey, the writer was favored by guidance and with conveyance by motor car which facilitated a general survey of the areas of phlox growing along Bound Brook and along Johnson's Creek. Only one white-flowered plant was seen at Bound Brook, and none were observed at Johnson's Creek, otherwise much the same variations as were seen on the Serpentine Barrens were observed here. It seemed, however, from the hasty survey made, that at Johnson's Creek there was perhaps a greater proportion of the lavender colors than was seen at the Serpentine Barrens.

It will at once occur to the reader that much of the variation discussed above may be regarded as what are rather popularly called "mutations." If we consider that these are spontaneous variations that may breed somewhat true, this conception may perhaps be applied. It appears that some of the forms do breed sufficiently true to be considered as good horticultural races. Of these an *alba* and a *lilacina* are frequently seen in cultivation, as is also a variety named *frondosa* which is of rather vigorous growth. The New Standard Cyclopedia of Horticulture lists twelve varieties now recognized in cultivation.

It may be noted in this connection that when the conception of mutation was first developed by de Vries, it was thought that the Mendelian conception of unit characters was very generally valid and that hybridization could not increase variability of the offspring with respect to a single character over that of the parents. Mutation was considered as a change in the organiza-

tion and nature of the germ plasm which brought new characters into existence by sudden and discontinuous variation.

These conceptions have become much modified by recent investigations. Characters come into expression not so much by independent action of units of plasm as by complicated interactions between such elements of germ plasm as can be roughly located by genetical analysis. Mutations have accordingly come to be regarded as spontaneous change, both of qualitative and quantitative nature, in one or more of the assumed units which are individually only indirectly concerned with the expression of a character.

Furthermore, the results of extensive experimental selections indicate clearly that the heritable variations in a species or even in a race are often very slight differences which present numerous gradations between the limits. The distinction between discontinuous variation or mutation, and variation that is decidedly indiscriminate and continuous in quite the Darwinian sense, is not at all clear on any basis of definition and classification.

The conditions seen in *Phlox subulata* also illustrate very well the fact that seldom does such indiscriminate variability seem to be a direct response to environment. The plants live side by side under the same environmental influences and the variations, or at least many of them, seem not to be related as cause and effect to these influences. This is one of the reasons for the tendency of our times to minimize the Darwinian view that hereditary and evolutionary changes are induced by environment. How, for example, can all the different flower colors seen in phlox be a direct or even an indirect response to the external conditions? Hence the general feeling that the changes upon which natural selection may later work are internal and are to large degree independent of environment.

Perhaps the variability seen for *Phlox subulata* as it grows at such localities as Unionville is largely produced by a result of the ability of the species to make a dense growth composed of great numbers of perennial plants, with the resulting interbreeding that ensues especially between forms that may arise by spontaneous variation.

Compared with a sister species, *Phlox Drummondii*, the "moss pink" appears to be much more variable in nature. The former, however, has been under cultivation since 1835, during which time there have developed over 200 recognized horticultural varieties,* which, considered as a whole, exhibit a much wider range of variability than is now seen in *Phlox subulata*. The conditions in *Phlox Drummondii* are an excellent example of the results of sporadic variation, of crossing between variations, and of selection, when a relatively simple species is cultivated intensively in new climates and special attention paid to the propagation of variations. What the limits of such variation would be for *Phlox subulata* were it given the same floricultural treatment can only be conjectured.

It would be of interest to know whether the "moss pink" exhibits much the same degree and intensity of variation throughout its range as is seen in the localities noted above, or whether there is a tendency to a geographic isolation or segregation of various forms. It would also be of interest to learn what the present biological type of the species is; that is, the form that is most widely distributed and which constitutes a plurality of individuals belonging to the species.

A. B. STOUT

FURTHER OBSERVATIONS ON PHLOX DRUMMONDII†

An account of the origin and history of the cultivated varieties of *Phlox Drummondii* has already been presented to readers of the *Journal*.‡ As there reported, it appears from the evidence that the many varieties of this species now in cultivation have descended as progeny of one collection of seed made by Thomas Drummond in 1835, and that the wild species of that time and even of the present time exhibits comparatively limited variability.

* Kelly, James P. Cultivated varieties of *Phlox Drummondii*. Jour. N. Y. Bot. Gard. 16: 179-191. 1915.

† Contributions from Dept. of Botany, no. 9. The Penn. State College.

‡ Cultivated Varieties of *Phlox Drummondii* by James P. Kelly. Jour. N. Y. Bot. Gard. 16: 179-191. 1915.

The writer can now report some observations on the variability of certain plants grown from seed recently obtained from wild plants near Austin, Texas, by Professor F. McAllister. Eight plants constituting a first generation were grown from this seed, and from the self-pollinated seed of one of these plants nineteen plants of a second generation were grown. All of these plants were remarkably uniform in habit of growth and in the color of the flowers. They were scarcely as robust as the larger of the cultivated varieties and the leaves were somewhat more hairy. The flowers were quite uniformly of a "phlox purple" color as classified by Ridgway's *Color Standards and Nomenclature*.

The plants derived from the seed collected by Drummond bore flowers of a rose-purple, as a plate accompanying the original description by Hooker shows.

In the case of the above mentioned twenty-seven plants derived from wild seed, however, there were somewhat noticeable variations in respect to the shape of the corolla-lobes. Among the eight plants of the first generation there were gradations from narrow to rather wide lobes. The second generation was grown from seeds of a plant with fairly wide-lobed flowers but among these plants the variation in the width of lobes was very decided, and presented a range from very narrow and widely separated to quite wide and slightly over-lapping.

One of the flowers of the plate published in 1835 to illustrate Hooker's description is so oriented as to show that the corolla-lobes were of medium width, that is, they were not exceedingly narrow, nor were they wide enough to overlap.

In the course of the many generations of *Phlox Drummondii* that have been cultivated, a wide range of variability has appeared. Many modern varieties show lobes so wide that they greatly overlap and, of course, are wider than the widest noted above. The writer has never seen a plant of the variety *radiata* mentioned in *Gartenflora* in 1903, but it evidently possesses corolla-lobes narrower than any described above. The limits of variation are wider apart in the species as it exists in cultivation to-day than they are in the wild strain of plants under observation.

Mention may here be made of a variation that has appeared in

the writer's cultures of hybrids between the two cultivated varieties *alba* and *Radowitzii*. *Alba* has pure white flowers whose corolla-lobes stand at right angles to their tubes. The corolla-lobes of *Radowitzii* are rose-colored, streaked with white, and occasionally showing green in narrow streaks; the *Radowitzii* lobes stand at an acute angle to the flower-tube, making the flower funnel-shaped. The first generation of four plants bore flowers which had the form of *alba* and the color was "phlox purple" with "aster purple" near the throat of each flower.

From self-pollinated seed of one of these plants a second generation of twenty-nine plants was grown. Of these twenty-one had flowers that were salverform, typical of *alba*; the other eight had funnel-shaped flowers. There was considerable variation in flower-color in this generation. Of the eight plants bearing funnel-shaped flowers one had flowers that were nearly pure white, but upon close examination these were found to be somewhat streaked with faint color. A second had a ground color also light, but strong enough to be identified as nearly "light hortense violet"; the lobes of the flower of this were also streaked with white. The other six plants with funnel-shaped flowers had these similarly streaked with white, but the ground colors varied; in one the ground color was "phlox pink"; in two it was "phlox purple"; in the sixth it was between "phlox purple" and "true purple"; the seventh had it "rose-pink" and the last was like the original *Radowitzii* parent.

The plant with funnel-shaped flowers described as the sixth in the last paragraph was the parent of an F_3 generation of fifteen plants. All of these bore funnel-shaped flowers, but there was some variation in flower color. Eleven had flowers of purplish color, the purple varying somewhat in hue, and four had pure white flowers.

An F_3 plant with white funnel-shaped flowers was the parent of six plants of a fourth generation which were all similar to their F_3 parent in respect to shape of corollas. In these occasional green streaks of chlorophyll appeared in the otherwise white corollas just as in the typical *Radowitzii*.

This sort of white streaked with green is not mentioned any-

where among the variations of *Phlox Drummondii* so far as the writer has been able to discover. It is new in the sense that it embodies in one flower characteristics that did not previously occur together. The funnel-shape occurred at the start associated with a rose color streaked with white and occasionally green; the entirely white condition existed only in the salver-shaped flower; the new variation exhibits in one flower the funnel-shape combined with the pure white condition, showing an occasional green streak. It remains to be determined whether this form will breed sufficiently true to be established as a variety.

Undoubtedly many of the varieties of *Phlox Drummondii* were produced by just such hybridization methods followed by selection.

JAMES P. KELLY

DEPARTMENT OF BOTANY,
PENNSYLVANIA STATE COLLEGE

HARDY WOODY PLANTS IN THE NEW YORK BOTANICAL GARDEN

(Continued)

Pinus rigida. PITCH or TORCH PINE.

Location: Pinetum, north slope of knoll northeast of Conservatory Range 1; also west slope of same knoll.

Natural distribution: Eastern North America.

Pinus Sabiniana. DIGGER PINE.

Location: Pinetum, north and east slopes of knoll northeast of Conservatory Range 1.

Natural distribution: California.

Pinus Strobus. WHITE PINE.

Location: Pinetum, west side of ridge west of Economic Garden and Herbaceous Grounds; east side of knoll east of Conservatory Range 1. East end of approach to elevated railroad. West end of Long Bridge. A small grove in the northeast corner of the Fruticetum. A fine specimen near south end of Lake Bridge. Demonstration White Pine Plantation on ridge near Iris Garden.

Natural distribution: Eastern North America.

Pinus Strobus var: **brevifolia**. DWARF WHITE PINE.

Location: Pinetum, along west side of ridge west of Morphologic Garden.

Pinus Strobus var: **fastigiata**. COLUMNAR WHITE PINE.

Location: Pinetum, along west side of ridge west of Herbaceous Grounds; also between road and path to west of this.

Pinus sylvestris. SCOTCH PINE.

Location: Pinetum, knoll northeast of Conservatory Range 1. South of Mansion.

Natural distribution: Europe and Asia.

Pinus sylvestris var: **argentea**. SILVERY SCOTCH PINE.

Location: Pinetum, knoll northeast of Conservatory Range 1; east side of knoll east of same range.

Pinus sylvestris var: **fastigiata**. PYRAMIDAL SCOTCH PINE.

Location: Pinetum, knoll northeast of Conservatory Range 1.

Pinus Thunbergii. JAPANESE BLACK PINE.

Location: Pinetum, northeast foot of knoll northeast of Conservatory Range 1; also north foot of knoll east of same range.

Natural distribution: Japan.

Pinus virginiana. JERSEY PINE.

Location: Pinetum, knoll northeast of Conservatory Range 1.

Natural distribution: Southeastern United States.

Cedrus. TRUE CEDARS.

Cedrus atlantica. MOUNT ATLAS CEDAR.

Location: Pinetum, ridge west of Economic Garden.

Natural distribution: Northern Africa.

Cedrus atlantica var: **aurea**. GOLDEN MOUNT ATLAS CEDAR.

Location: Pinetum, with the above.

Cedrus atlantica var: **glauca**. BLUE MOUNT ATLAS CEDAR.

Location: Pinetum, with the above.

Cedrus Deodara. DEODAR or INDIAN CEDAR.

Location: Pinetum, east slope of ridge south of Economic Garden.

Natural distribution: Himalayan Region.

Cedrus Libani. CEDAR OF LEBANON.

Location: Pinetum, with *Cedrus atlantica*.

Natural distribution: Syria to Asia Minor.

Larix. LARCHES

Larix Larix (*L. decidua*). EUROPEAN LARCH.

Location: Pinetum, ridge west of Morphologic Garden.

Natural distribution: Mountains of central Europe.

Larix laricina. AMERICAN LARCH or TAMARACK.

Location: In low land near river, east of Fruticetum. North border.

Natural distribution: Northern North America.

Larix leptolepis. JAPANESE LARCH.

Location: Pinetum, ridge west of Morphologic Garden.

Natural distribution: Japan.

Pseudolarix. CHINESE LARCH

Pseudolarix Kaempferi. GOLDEN or CHINESE LARCH.

Location: Pinetum, on ridge west of Morphologic Garden.

Natural distribution: Northern China.

Picea. SPRUCES

Picea Abies (*P. excelsa*). NORWAY SPRUCE.

Location: Pinetum, south of Forsythia group near Station Plaza.

Natural distribution: Europe.

Picea Abies var: **aurea.** GOLDEN NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **Barryi.** BARRY'S NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **compacta.** COMPACT NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **conica.** CONIC NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **conica densa.** DENSE CONIC NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **Finedonensis.** PALE YELLOW NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **Gregoryana.** GREGORY'S NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **inversa**. DROOPING NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **Maxwellii**. MAXWELL'S NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **pendula**. WEEPING NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea Abies var: **pyramidalis**. PYRAMIDAL NORWAY SPRUCE.

Location: Pinetum, with the above.

Picea bicolor. ALCOCK'S SPRUCE.

Location: Pinetum, along west border south of Station Plaza
near Hydrangea group.

Natural distribution: Japan.

Picea canadensis. WHITE SPRUCE.

Location: Pinetum, along west border, south of Station Plaza.
West end of Long Bridge.

Natural distribution: Northern North America.

Picea canadensis var: **coerulea**. BLUE WHITE SPRUCE.

Location: Pinetum, south of Forsythia group at Station Plaza.

Picea canadensis var: **nana**. DWARF WHITE SPRUCE.

Location: Pinetum, with the above.

Picea Engelmannii. ENGELMANN'S SPRUCE.

Location: Pinetum, knoll northwest of Conservatory Range 1.

Natural distribution: Western North America.

Picea Engelmannii var: **glauca**. BLUE ENGELMANN'S SPRUCE.

Location: Pinetum, with the above.

Picea Mariana var: **Doumetii**. DOUMET'S BLACK SPRUCE.

Location: Pinetum, along west border south of Station Plaza;
near Hydrangea group.

Picea Maximowiczii. MAXIMOWICZ'S SPRUCE.

Location: Pinetum, with the above.

Natural distribution: Japan.

Picea obovata. SIBERIAN SPRUCE.

Location: Pinetum south of Forsythia group near Station
Plaza.

Natural distribution: Northeastern Europe and western Asia.

Picea Omorika. SERVIAN SPRUCE.

Location: Pinetum, along west border south of Station Plaza;
near Fountain Enclosure.

Natural distribution: Southeastern Europe.

***Picea orientalis*.** ORIENTAL SPRUCE.

Location: Pinetum, near path crossing, northwest of Conservatory Range 1; along west border south of Station Plaza; near *Hydrangea* group.

Natural distribution: Western Asia and Caucasus.

***Picea polita*.** TIGER-TAIL SPRUCE.

Location: Pinetum, north slope of knoll northeast of Conservatory Range 1.

Natural distribution: Japan.

THE NEW GARDEN SCHOOL

(WITH PLATE 194)

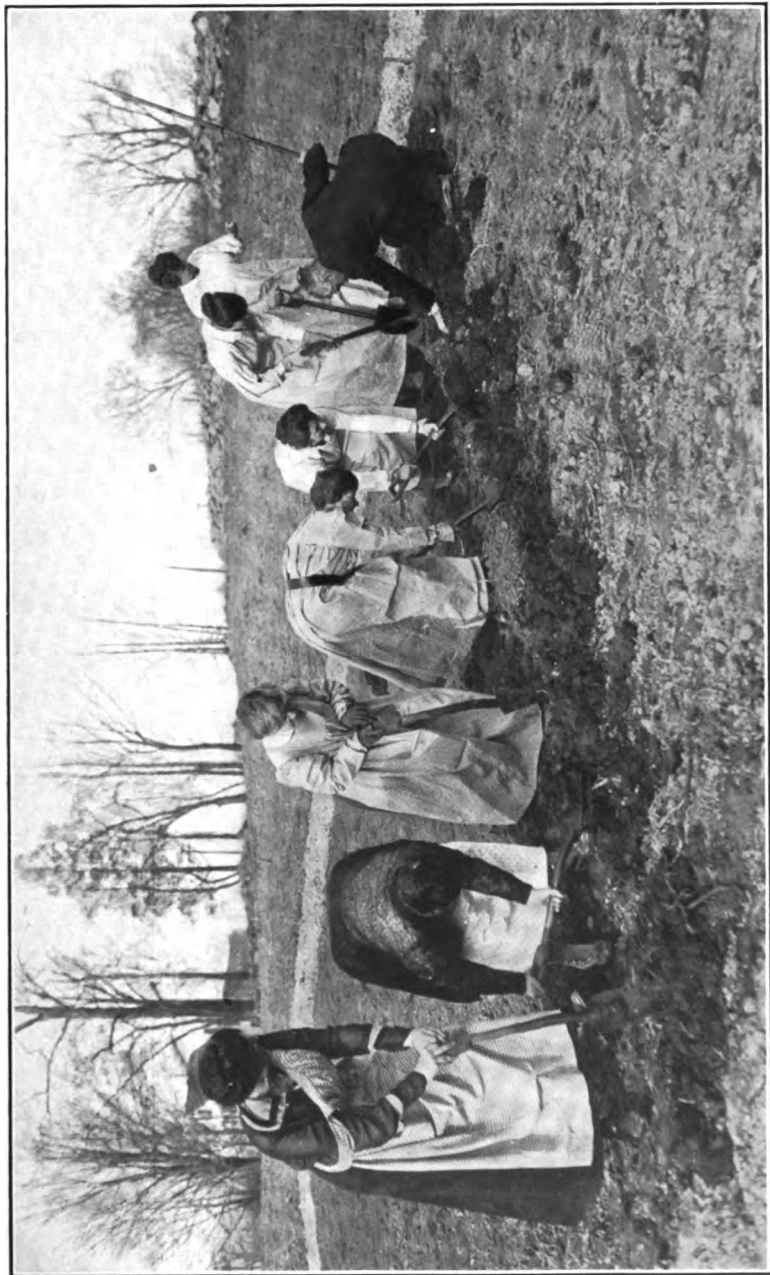
The commencement of instruction in gardening in cooperation with the International Children's School Garden League, outlined in the March issue of the JOURNAL, was auspiciously inaugurated on the afternoon of March 29 in the new lecture room at the Mansion. Members of the Women's Auxiliary received Trustees and other members of the School Farm League, and Mr. Henry G. Parsons, the newly-appointed Supervisor of Gardening Instruction, described the plan and scope of teaching and the installation of home and school gardens. Remarks were also made by President Thompson and by the Director-in-Chief.

On the afternoon of April 2, two courses were begun, (1) a home garden course for those desiring to conduct their own gardens, to be given on the five afternoons of April, and (2) a special course of six weeks, five afternoons a week, based on the announced course for teachers of school gardens, somewhat modified.

The following students were registered:

1. *For the Home Garden Course*

- Mrs. E. H. Anderson, Scarsdale, New York.
- Miss H. C. Blake, 128 Central Park South, City.
- Mrs. Jennie V. Combs, Scarsdale, New York.
- Miss May Corbett, Montclair, New Jersey.
- Mrs. Albert Fries, 9 West 82d Street, City.



Courtesy of Underwood & Underwood

Garden school. The first spading lesson of the first class.

Mrs. Sybil T. Hirsch, White Plains, New York.
 Mrs. William Naumberg, 21 West 83rd Street, City.
 Miss Gertrude Parsons, 110 East 36th Street, City.
 Miss T. E. Phillips, 850 West End Avenue, City.
 Miss Clara A. Stenns, 500 West 122d Street, City.
 Mrs. A. G. Son, White Plains, New York.
 Mrs. W. H. Vialle, 419 West 119th Street, City.
 Mrs. Josephine V. Winslow, Scarsdale, New York.

2. *For the Special Course*

Mrs. William H. Andrews, 130 East 67th Street, City.
 Mrs. Helen Biddle Griscom Bettle, 101 East 72d Street,
 City.
 Miss Ethel Burnet, 937 Madison Avenue, City.
 Miss Gail Gardner, 14 West 65th Street, City.
 Miss Anne Hoyt, Bronxville, New York.
 Mrs. Marion Kinney, Essex Hotel, City.
 Miss Harriet McKee, 830 Park Avenue, City.
 Mrs. Butler Williamson, 944 Park Avenue, City.

CONFERENCE NOTES

At the monthly conference of students, investigators and staff held on March 7th, Dr. Benjamin Horowitz presented a preliminary report, with demonstrations, of results of various researches in the study of plant pigments. For several years Dr. Horowitz and Professor W. J. Gies have been studying the pigments of flowers and of variegated leaves, using especially material obtained at the Garden. It is planned to present the results of this research in a future number of the JOURNAL OF THE NEW YORK BOTANICAL GARDEN.

A. B. STOUT,

Secretary of the Conference.

NOTES, NEWS AND COMMENT

The following visiting botanists have registered in the library during March: Chester J. Hunn, Ithaca, N. Y.; Professor Francis E. Lloyd, Montreal, Canada; Professor Mel T. Cook, New Brunswick, N. J.

Professor F. E. Lloyd, of McGill University, visited the Garden on March 24 for consultation with Professor Hus in regard to investigations pertaining to production of rubber from *Hevea*.

Mr. C. G. Lloyd, of Cincinnati, has presented to the Garden a complete set of all known species of puffballs, based on his extensive and long-continued studies of this group. The value of this contribution can hardly be estimated.

Sorauer has recently made observations on house plants and finds that injury from burning gas in rooms is negligible and is easily avoided entirely by ventilation. The chief injuries are probably due to the elevation of temperature and the drying of the atmosphere by means of fires or heaters.

Farmers' Bulletin 789 of the U. S. Department of Agriculture treats of certain insects that attack mushrooms and the means of controlling them. The chief insects considered are maggots, mites, springtails, and sowbugs, the first class being the most important. The author, C. H. Popenoe, concludes that if the mushroom house is carefully constructed and all outlets closed or screened; if the spawn is purchased from reliable dealers; and if the compost is carefully prepared and kept at as low a temperature as possible, there should be little necessity for the radical measures of fumigation, sterilization, or destruction of the mushroom beds.

Dr. E. A. Burt has recently completed a study of the Thelephoraceae collected by Dr. W. A. Murrill in Mexico, and reports many interesting species, quite a number of which are new. These will be published in Dr. Burt's series of articles now appearing in the *Annals of the Missouri Botanical Garden*.

Professor George Massee, the well-known English mycologist, died on February 17 at the age of sixty-seven. Professor Massee

was long connected with the Royal Botanic Garden at Kew and published many books and papers on mycology. His private collection of fungi and drawings was purchased by the New York Botanical Garden some years ago. He has been one of the associate editors of *Mycologia* since 1911.

Meteorology for March.—The total precipitation for the month was 3.71 inches of which 1 inch (10 inches snow measurement) fell as snow. The maximum temperatures recorded were 40° on the 1st, 48° on the 10th, 52° on the 13th, 58° on the 24th and 57° on the 31st. The minimum temperatures were 30° on the 2nd, 12.5° on the 7th, 18° on the 20th, and 33° on the 30th.

ACCESSIONS

MUSEUMS AND HERBARIUM

- 2,261 specimens of flowering plants from the United States. (By exchange with the Missouri Botanical Garden.)
- 649 specimens of fungi from Porto Rico. (Collected by Prof. F. L. Stevens.)
- 21 specimens of flowering plants from California. (Given by Mr. S. B. Parish.)
- 23 colored lantern slides. (Given by Mrs. N. L. Britton.)
- 165 specimens of flowering plants from the local herbarium. (Given by Mr. L. H. Lighthipe.)
- 4 specimens of hepaticae from Texas. (Given by Mr. E. L. Reed.)
- 32 specimens of flowering plants from the western United States. (Given by Dr. H. H. Rusby.)
- 8 specimens of roses from Minnesota and South Dakota. (Given by Mr. L. R. Moyer.)
- 2 specimens of fungi from China. (By exchange with the United States Department of Agriculture.)
- 1 specimen of woody fungus from Ohio. (By exchange with Mr. C. M. Scherer.)
- 1 cotype specimen of *Claudopus subnidulans* from Missouri. (By exchange with Dr. L. O. Overholts.)
- 1 specimen of *Polyporus pini-ponderosae* from New Mexico. (By exchange with Mr. W. H. Long.)
- 1 specimen of *Fomes arclostaphyli* from Arizona. (By exchange with Mr. W. H. Long.)
- 1 specimen of *Leptonia euchlora* from New York. (By exchange with Dr. H. D. House.)
- 2 specimens of fungi from North Dakota. (By exchange with Dr. J. F. Brenckle.)
- 1 specimen of *Peziza sylvestris* from California. (By exchange with Dr. L. O. Overholts.)

30 specimens "Fungi Columbiana," fascicles 49, 50, and 51. (Distributed by E. Bartholomew.)

8 specimens of crude drugs. (Given by Dr. H. H. Rusby.)

25 specimens "North American Musci Pleurocarpi," numbers 450-475. (By exchange with Dr. A. J. Grout.)

56 specimens of flowering plants from Colorado. (By exchange with Mr. J. W. Clokey.)

4 specimens of Hepaticae from Florida. (Given by Mr. Severin Rapp.)

PLANTS AND SEEDS

3 plants of *Juglans nigra*, for Arboretum. (Given by Mr. John Finley.)

40 plants, *Ampelopsis humilis* and *Populus Simonii*. (By exchange with U. S. Dept. of Agriculture, Bureau of Plant Industry.)

9 plants, *Populus* sp., for Nursery. (Collected by Dr. N. L. Britton.)

1 packet of seeds of *Peganum Harmala*. (By exchange with Botanic Garden of Tiflis, Russia.)

3 packets of seeds. (By exchange with U. S. Dept. of Agr., Bureau of Plant Industry.)

1 packet of seeds from British Columbia. (Given by Prof. F. Boas.)

1 packet of seeds of *Crinum americanum*. (Collected by Dr. J. K. Small.)

50 packets of California seeds. (Purchased.)

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NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

JOURNAL

OF

The New York Botanical Garden

EDITOR

FRANCIS WHITTIER PENNELL

Associate Curator

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JOURNAL

OF

The New York Botanical Garden

VOL. XVIII

May, 1917

No. 209

COURSES IN GARDENING IN COOPERATION WITH THE INTERNATIONAL CHILDREN'S SCHOOL FARM LEAGUE.—SECOND ANNOUNCEMENT.

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Tuesdays in June and first Tuesday in July, 4.30 P.M.

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Soil and preparation.

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What and how to plant. Transplanting. Food values.

Relation of sunlight, air, and water to the garden.

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Mondays, Tuesdays, Wednesdays, Thursdays and Fridays,
July 9th to August 17th, 1917, from 9.30 A.M. to 12.30 P.M.

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How, by proper planning, a teacher may take a full class into the garden and do effective work in the ordinary class period.

How the garden will furnish material of educational value, alive with interest, which will aid and inspire the regular classroom studies of reading, writing, arithmetic, language, drawing, geography, and history.

Instruction will be given, by lectures, practice work, and reading, in those subjects needed by teachers in school garden work, and connected classroom experiments.

Laboratory and garden tools will be supplied without charge.

The fee for each course will be twenty-five dollars, which will include necessary materials and supplies.

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Introduction. The school garden an educational laboratory planned for the child's development. The teacher's attitude.

Correlation. Examples of how to use the garden problems in classroom work.

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Soil and fertility. Fertilizers and manures.

Seeds. Selection. Germinating. Planting. Transplanting.

Thinning. Proper spacing.

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III. *Special or Partial Courses* in gardening may be arranged if applications are sufficiently numerous.

IV. *Autumn Course.*

Mondays, Tuesdays, Wednesdays, Thursdays and Fridays, September 10th to October 26th, from 4 to 5.30 P.M. The fee for this course will be twenty dollars, which will include necessary supplies and materials.

LECTURES.

Seeds, weeds, composting, fertilizers, fall tillage, cover crops. Food values.

GARDEN PRACTICE.

Harvesting of seeds, of plants and of root crops. Fall fertilizing and spading. Compost pits and their contents. Fall planting. Plant protection for the winter.

LABORATORY.

Experiments and shop work.

V. *Greenhouse Courses* will be organized for November and December, 1917, and for January and February, 1918, to include lectures, greenhouse bench work, propagating, potting, seed testing, hot-bed and cold-frame practice. These courses will be described in detail later in the year.

All correspondence relative to these courses should be addressed to

HENRY GRISCOM PARSONS,
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Access to the School Garden and to the Mansion is most convenient from the new Pelham Parkway Station of the White Plains Road extension of the Subway, walking west on the Bronx and Pelham Parkway and north on either the Bronx Boulevard or on paths which lead to the Mansion. Access can also be had by a somewhat longer walk from the terminal (Botanical Garden or Bronx Park) station of the Third Avenue Elevated Railway, walking east through the Flower Gardens and Hemlock Forest to the Mansion. The Southern Boulevard trolley line reaches the southwestern corner of the Botanical Garden at the junction of Southern Boulevard and Pelham Avenue, from which point access to the Mansion and School Garden can be had by walking east on Pelham Avenue and north to the Mansion.

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N. L. BRITTON,
Director-in-Chief.

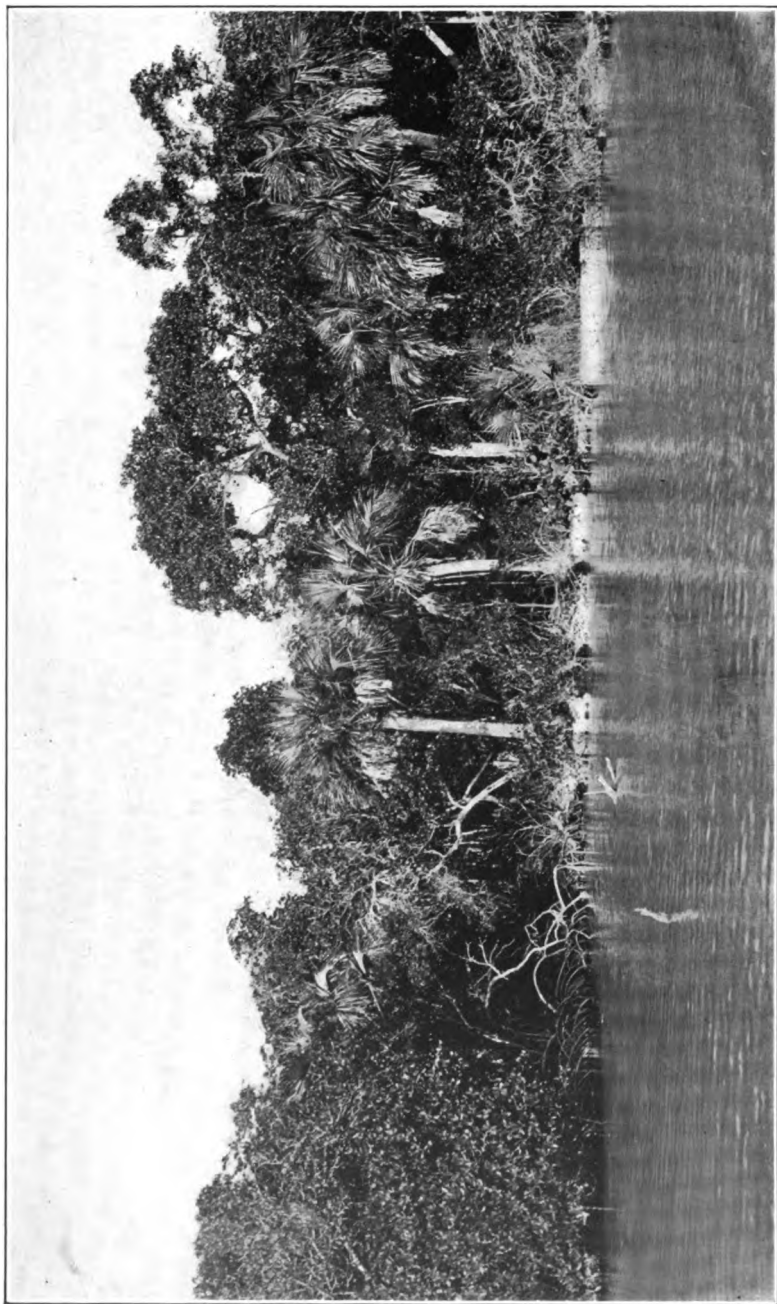
BOTANICAL EXPLORATION IN SOUTHERN FLORIDA IN 1916

WITH PLATES 195-199

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: With your permission I spent January of last year in southern Florida in continuation of general botanical exploration and in photographing the vegetation of the region. During the first two days devoted to field-work, I had the company of Professor R. A. Harper, Professor Tracy Hazen, and Dr. Cecil Yampolski, all of Columbia University.

The initial trip was to Sands' Key. We went there in search of a slender-stemmed cactus that had been reported to occur on that island. Our search was successful, but instead of finding an addition to our cactus flora, we discovered that the seedling plants of the large, and viciously armed dilldoe, *Acanthocereus pentagonus*, are little plants with elongate slender stems about



Madaira Bay region, Fla. Shore of Madaira Bay in foreground. Edge of Madaira Hammock in background. This is the southernmost hammock on the Florida peninsula, except those of the Cape Sable region. It received its name from the Madeira-redwood or Mahogany-tree which grows mostly everywhere in the hammock.

as thick as an ordinary lead-pencil and armed with quite soft spines; altogether so different from the mature state of the plant, that one would not suspect that the two extremes represented the same species, if he had not seen the seedling plants further developed and with the new growths by successive steps taking on the form of the adult. In addition to this discovery, we settled the question about the eligibility of *Maytenus* to our tree-flora list. Its right to inclusion among the trees has always been questioned or disputed except by the writer. On Sands' Key we found tree trunks over a foot in diameter, a fact that should remove all doubts as to whether this plant is a tree or not, and in addition to this evidence, last year Mr. George A. Orrok reported to me the occurrence of trees equal in size to those on Sands' Key growing on Captiva Island on the western coast of Florida near the mouth of the Caloosahatchee River. Another interesting discovery was the Bahamian nightshade, *Solanum bahamense*, growing as a vine, and climbing high in the trees.

The following day was devoted to an excursion to Royal Palm Hammock.* Four subsequent visits were made to this hammock during the month, and much of its area was then explored. The royal palms were in the height of their flowering during January. The massive plumes of white flowers in contrast to the crown of bright green leaves above them presented an impressive sight. Many interesting observations were made and several may be recorded here. The myrtle-of-the-river, *Calypttranthes Zyzugium*, mentioned in my report of last year's work, was found to be one of the most abundant of the shrubs and trees of the island. It grows nearly everywhere, except in the low places. The foliage is peculiarly conspicuous on account of the striking shade of green in its leaves. Another vine was added to our list of climbing plants, namely, the French-mulberry, *Callicarpa americana*. This common shrub was found in the jungle clambering quite high over other shrubs and up into the branches of the trees. It is one of the few shrubs that range all the way from

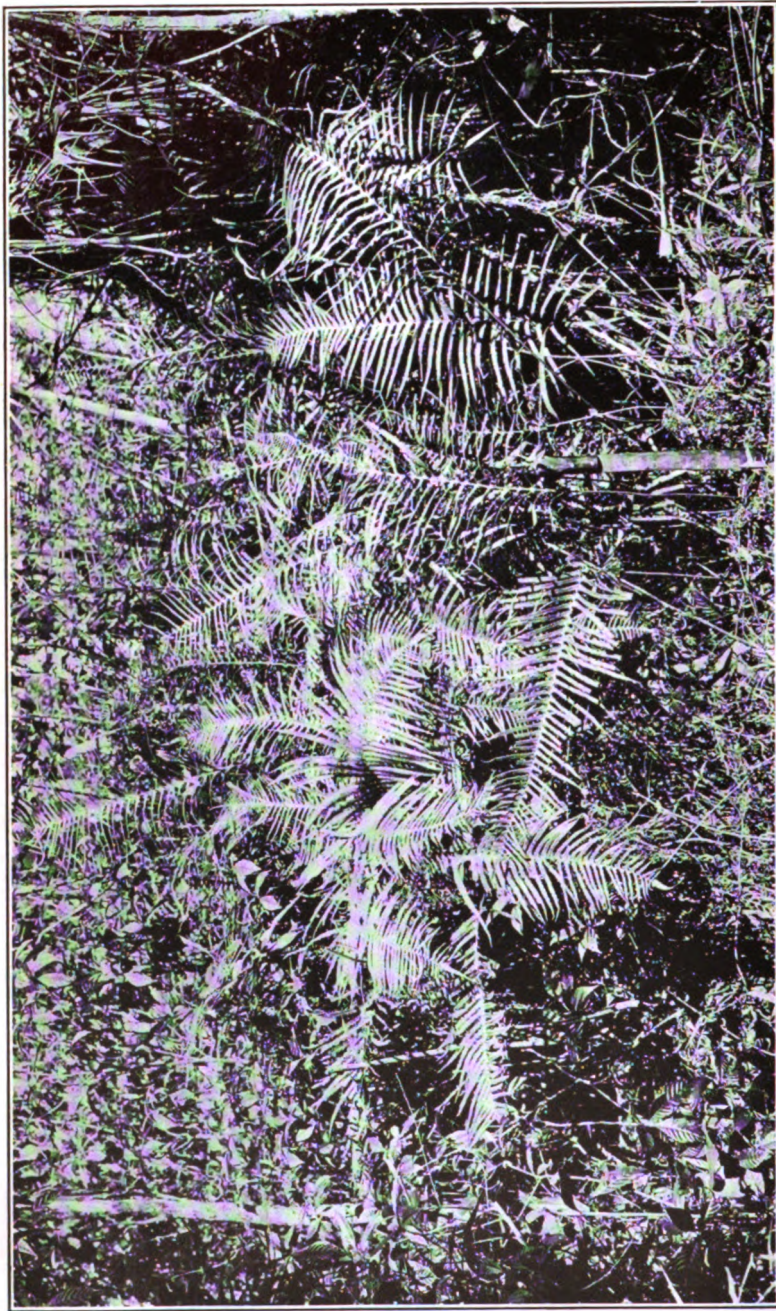
* A separate paper has been devoted to Royal Palm Hammock which has recently become a public reservation. Journal of the New York Botanical Garden 17: 165-170. 1916.

the Appalachian mountains of Virginia and North Carolina to the southern end of the Everglades. It flourishes about equally well at both extremes of its range.

Royal Palm Hammock furnishes an interesting reversal of the normal phytogeographic conditions of the region. On the Everglade Keys we have extensive pinelands. These surround, here and there, small areas with hammock growth. Royal Palm Hammock is, as the word hammock means, a dense growth of broad-leaved shrubs and trees; but the wind, during hurricanes, or perhaps in less violent storms, has carried seeds from the pine trees growing in distant pinelands and dropped them in the more open places on this everglade hammock. Thus in open and otherwise favorable spots pine trees have sprung up, singly or in groups, and here and there we find small areas of pineland in a hammock. These areas of pine-woods are small, but they are characteristic and even have the saw-palmetto which is nearly always present in the pine-woods on the Everglade Keys. The seeds of this plant were not, however, carried there by the wind, but by animals, most likely by the bear, which up to a few years ago was very abundant throughout this region. Perhaps, if the rock surface of Royal Palm Hammock and the surrounding Everglades were slightly more elevated and the natural protection from fire thus removed, Royal Palm Hammock would long ago have been transformed into a pine island, nearly or quite devoid of hammock.

About ten of the more interesting hammocks mentioned in my report on exploration in 1915 were visited for the purpose of collecting certain plants and making photographs of especially interesting objects.

Two short periods, between visits to the hammocks of the Everglade Keys, were spent in further exploration of the Florida Keys. On one of these cruises the northern end of Key Largo, Angelfish Key, and Palo Alto Key were visited. Key Largo and Palo Alto Key both have some beautiful original forest in which many interesting plants grow. There we found an orchid not before collected on the Florida Keys, and a tree not before found on the Upper Florida Keys. On Angelfish Key we were



In a hammock on the Long Key pineland, Fla. Bed of a very rare wood fern, *Dryopteris augustens*, in foreground. Some of the fern-leaves measured over nine feet in length, and some of the blades were almost three feet wide.

surprised to meet with a copious growth of perhaps our hitherto rarest shrub, *Vallesia*, a member of the dogbane family. Previously it was known in our flora only on Key West. Outside of Florida it is known in the West Indies, in Lower California, and in Chile. On a subsequent cruise the flora of other parts of Key Largo was investigated, and the hammocks of Meig's Key and of Elliott's Key were also visited.

Of the several new hammocks explored, the two more interesting ones are located at the extremities of our field of activities on the mainland during the period under consideration. The one is located in the Long Key pineland, the other in the Everglades west of Little River. At each of these hammocks I was accompanied by Mr. Charles A. Mosier, who discovered the former hammock accidentally several months previous to my visit and who had visited the Everglade hammock several years previously.

The exact location of this Long Key hammock is not determined, but if, after crossing the Everglades from a point where the Ingraham Highway emerges from the western side of Royal Palm Hammock, to the nearest point on Long Key, a north-western course is followed through the pine forest and across two prairies, one cannot fail to encounter the hammock. This hammock conforms to the invariable rule of the hammocks of the Everglade Keys, in that its flora has individual characteristics and its vegetation, to some extent, is distinctive. Its lime-sinks yielded one kind of West Indian maiden-hair, not known elsewhere on the North American continent. This fern is of interest otherwise in that it has the fragrance of the northern sweet vernal grass in drying. This hammock is rich in orchids. Many of the widely distributed species are present, and in addition to these the *Brassia*, heretofore known in the United States only from the Nixon-Lewis Hammock in the Biscayne pineland, and the *Macradenia* known hitherto only on Royal Palm Hammock, are both quite plentiful.

The incursion to Roberts Island, as the Everglade Key above referred to is locally known, after plans for going there had miscarried many times, took place on January 23. We went by

automobile through the pinewoods to the edge of the Everglades. There afoot we took to the water and mud, and waded for a distance of three miles in a westerly direction in water mostly knee-deep and mud at the same time half as deep or of equal depth, until we reached the hammock. The trip requires strenuous wading, which must of necessity be made at a pace compared with which a funeral march would seem quite rapid; but the objective is worth the effort. This island is several miles long, standing north and south in the Everglades, and about a quarter of a mile wide. It is densely forested throughout. Much of its surface is so low that it is submerged during the rainy season. The soil of the low parts is mud and humus. This supports an almost impenetrable jungle made up mainly of pond-apple trees, cocoa-plum trees, and red-bay trees, and ferns. There are ferns by the square rod and ferns by the acre. The Boston fern and the sword-fern constitute the largest and most beautiful beds. Several kinds of epiphytic ferns and a few species of air-plants often cover the limbs of the trees. The higher ground of the island is sandy. There the live-oak is the dominating tree of the forest, and each tree constitutes a hanging garden. Orchids, air-plants, and ferns completely clothe the limbs of the larger trees. However, plants do not have a monopoly of the trees. There are also epiphytic lizards and epiphytic snakes! There is everywhere present a beautiful green snake. It inhabits the hammocks and it is especially abundant in those of the Everglades. It lies outstretched on the branches of shrubs and trees and glides along the branches from one tree to another with surprising ease. One has usually to be careful to look before laying hold of the limb of a tree for support, or he may grasp something of quite different consistency from that of wood!

The shrubs and herbs here represent more northern kinds than are met with in the hammocks of the nearby Everglade Keys. Among the more interesting discoveries on this island was a gigantic plant of the comptie, *Zamia pumila*, a cycad related to the Florida arrowroot, *Zamia floridana*, which is very common in the pinewoods of the Everglade Keys. The former cycad grows in the hammocks of peninsular Florida mostly north of

the New River, and it had not previously been found south of Fort Lauderdale. The specimen mentioned had a very large branched underground stem, and an unusually fine cluster of leaves each one over four feet tall. So striking was the plant, that we dug it up, photographed it, and replanted it.

After a profitable day on this island, we retraced our steps through the Everglades and found our automobile without special incident, except that one member of the party got his legs tangled in the coils of a large water-moccasin, and in the excitement and confusion of trying to get away in a hurry he fell prone in the mixture of mud and water. Both snake and man were equally surprised at the sudden meeting and neither had time to harm the other.

About the spot where this incident happened we discovered the beefwood or Australian-pine growing in the wet Everglades. The seeds had evidently been blown in during a storm or hurricane from trees growing near the coast.

The last week of field-work was devoted to a cruise to the lower Florida Keys. We sailed from Miami one forenoon and late in the evening of the same day we cast anchor for the night in the Bay of Florida just off the mouth of Tavernier Creek at the southern end of Key Largo. The night was warm and calm and the sky was cloudless; but simultaneous with daybreak we were suddenly awakened by the breaking of a "norther" which was ushered in by several flashes of lightning and a wind-squall that nearly swept loose objects from our decks. The gale caused our anchor to drag, thus blowing us rapidly toward the neighboring shore. The storm was accompanied as usual by an uncomfortable chillness caused by the sudden fall in temperature and by the continued strong wind from the north. We got under way at once to avoid being blown on shore, and as the engine was working well we continued southwestward on our proposed course without further delay. The sea became very rough as we went on and on emerging into the open part of the Bay of Florida we were forced to seek the shelter of Lignum-vitae Key for a short respite, both in order to get the salt out of our eyes and to avoid taking too much water aboard.

There we made collections on that island, which somewhat resembles Pumpkin Key in Card Sound, but with a less interesting hammock.

After several hours delay, during which time the wind abated slightly, we again started toward our destination, and made a harbor near the western end of Vaca Key just after dark. An early start next morning brought us to Big Pine Key in the forenoon. Before crossing over to No Name Key, our objective, we called on the oldest resident, the leading citizen, the postmaster, the express agent, the station agent, the merchant, and the banker, and also a good friend of all visitors to Big Pine. This formality and pleasure did not consume much of our time, as these distinctions, offices, and vocations are invested in one man, namely, Mr. Thomas Knowles, who has helped our exploration there by his personal company, by information, and by putting his house at our service. After casting anchor in a harbor on the western side of No Name Key, we at once went ashore to investigate the island. No Name Key, like a half dozen of the neighboring islands, has extensive areas of both pineland and hammock.

These islands, and the other keys west of the region of Bahia Honda channel, are of limestone similar to that of the Everglade Keys, and not of coral rock of which the Upper Florida Keys are built up. The naturalists of a generation back considered the Florida Keys to be a uniform chain of islands. However, our studies in the plants of the region in connection with our exploration of the Everglade Keys, and Mr. W. J. Krome's investigations during the construction of the Key West Extension on the Florida East Coast Railway, disclosed the fact that the groups of Keys we have designated elsewhere* as the Upper Florida Keys and the Lower Florida Keys are of different rock, of different geological ages, and thus quite naturally support different floras. Although of the same kind of limestone, the exposed surfaces of the Lower Florida Keys and the Everglade Keys are different in appearance. However, this difference is superficial, and it is easily explained. The superficial erosion

* Flora of the Florida Keys, iii-iv. 1913.



Lime-sink in hammock on Key Largo, Fla. Fallen tree-trunk clothed with resurrection-fern in foreground. Leather-fern in bottom of sink in background.

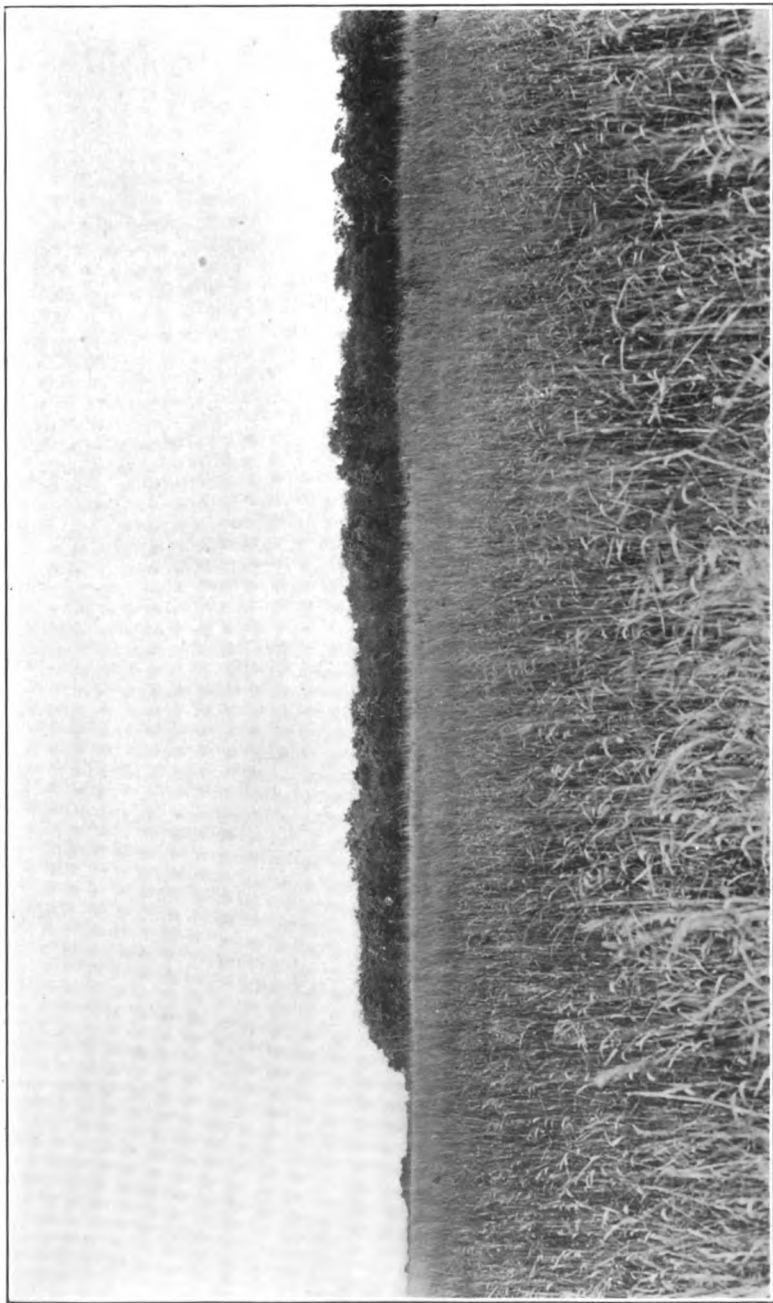
of the rock of the Florida Keys has resulted in a plate-like surface. It has the appearance of having been swept and polished. The storms and hurricanes of ages have brought this condition about. The exposed position of the islands and their slight elevation above tide has permitted the sea to sweep over them from all directions and thus wear down uneven places on the surface, as well as to carry away the decaying vegetable matter and the humus. Thus important factors in the superficial erosion, the acids of the decaying leaves and other vegetable matter and those of the resulting humus, have been largely eliminated. The natural accumulation of humus would produce the opposite condition from that which there obtains. In other words, the leaching-out process is mostly wanting on the Lower Florida Keys, except along the shore lines where the continual action of the tide and the waves leaches out the softer parts of the rock mechanically rather than chemically. The results of chemical leaching are clearly shown on the neighboring mainland of the peninsula.

In the case of the Everglade Keys, all of which are sheltered from the sweeping effect of the sea, we have a quite different rock surface resulting from a quite different mode of erosion. Here the action of rain-water is not counteracted, and the more or less extensive accumulation of humus with its dissolving acids has leached out the softer spots and thus instead of a pavement-like surface we find a surface honeycombed with all sizes of cavities. Further, in the pinelands whose humus has been burned up for ages by forest fires, first as a result of lightning, later by the carelessness or wantonness of man, we find a surface honeycombed with apparently small and shallow cavities; in the hammocks, which have been fire-proof, so to speak, and consequently with copious humus and a perpetual humid atmosphere, we find a surface honeycombed with large and deep cavities. There the surface is so different from that of the pine-lands that the cavities are called "pot-holes," "lime-sinks," or "erosion-holes." It is the hammocks that have made the lime-sinks. The lime-sinks are not responsible for the hammocks as is commonly believed.

No Name Key is the type locality or the place where several kinds of flowering plants new to science were first found during the last century. We rediscovered some of these species and, in addition, found the Bahamian *Savia*, a shrub or tree of the spurge family, heretofore known in the United States only from Big Pine Key. Many interesting plants, herbs, shrubs, and trees, clothe the plate-rock surface of this island. The rocks seem too smooth and dry to support vegetation at all, particularly in the pinelands where the humus is scant, and where rays of the tropical sun have direct access to most of the pavement-like surface. Palms thrive exceedingly well. In the pinelands of the Everglade Keys we have a copious growth of stunted saw-palmetto, and occasional stunted silver-palms, or half-starved cabbage-palms. On No Name Key the pine trees are accompanied by a growth of wonderfully developed thatch-palm and silver-palm which sometimes rivals the pines themselves. The young trees of both these palms are very thrifty, with stout trunks and heavy crowns; but as the trees get older the trunks increase greatly in length but not so much in diameter, and the crown of leaves is much diminished in size. The older trees often suggest slender fish-poles with a small brush-like tuft of leaves on the top.

The second day on this island was devoted to crossing to the eastern shore through pineland and hammock towards the southern end and then recrossing to the western side further north. The western side of the Key is mostly pineland, while the eastern side is mostly hammock. The hammock is rather stunted, but dense, and it has formed considerable humus on the floor. This condition leads the inhabitant there, as elsewhere, to clear the land for the cultivation of crops.

As we have already said, natural agencies are slowly destroying the Florida Keys and consequently, in all probability, many kinds of plants that once grew on them have disappeared. Man is destroying hammock and pineland, both wantonly and of necessity, much more rapidly than nature. Before long much of the natural vegetation of the region will be known only in places to which it may have been transplanted, or in the herbarium specimens we secure and preserve in our museum collec-



In the Everglades west of Little River, Fla. Everglade prairie in foreground. Everglade hammock, Roberts Island, in background. Many islands, usually smaller than this one, are scattered over the eastern edge of the Everglades.

tions. On the return trip we stopped to make collections on several keys.

We first visited Johnson's Keys, which lie eastward of No Name Key. The next landing was on Bahia Honda Key, where several plants grow that are not known elsewhere in the flora of the United States. After this we visited, successively, Ohio Key, Rachel Key, Bamboo Key, and Key Largo. Rachel Key may be recognized by its lone cocoa-nut tree. Its rocky surface is clothed with dense hammock, except where it has been cleared for cultivation. There we found the aloes growing naturally. This discovery adds an African plant to our naturalized flora. Bamboo Key may be recognized by the absence of bamboo, or any plant like it, and also by the absence of shrubs and trees, except scattered plants of the wild-cotton. Its surface, unlike that of Rachel Key, is composed of loose small fragments of sea-shells. There, also, we found quantities of aloes growing naturally; but its most interesting plant is the common asparagus! Asparagus plants were evidently introduced there in some way, and now they have taken possession of large areas. This plant of temperate regions seems to thrive just as well on this tropical island; there it has no winter resting period, but grows from one end of the year to the other, and, like the wild-cotton plants with which it grows, it both flowers and fruits without cessation.

Card Point, a small cape projecting eastward from the mainland, was visited and its hammock explored. Here, as along most of the coast-line of the Florida peninsula south of Cutler, the mangrove lines the shore. Several projections also support hammock. Growing with the native plants in this hammock we found the beefwood or Australian pine. This tree is becoming more and more common as a naturalized plant in southern Florida. It will grow well in almost any situation; from a distance we noticed it along the uninhabited shore of the peninsula at several points where seeds had evidently been blown by storms or had been washed ashore during high tides. After a short stop on Key Largo for the purpose of making some photographs of ferns, we weighed anchor and proceeded back to Miami and Buena Vista.

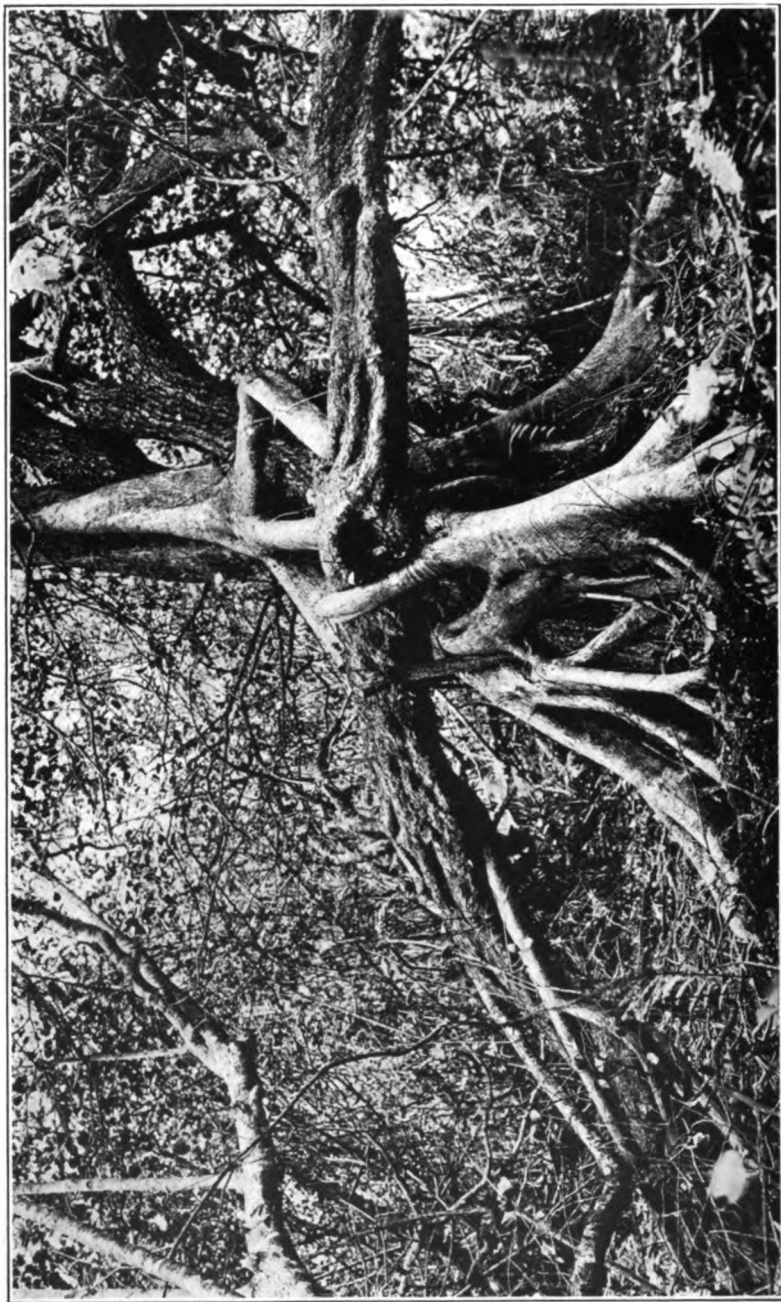
An unexpected call to southern Florida during the latter part of November and the first part of December gave opportunity for further exploration. The time was devoted largely to hitherto unvisited territory. A dozen points in the Everglades not previously visited were investigated, and each one disclosed plants of interest. Several new hammocks were found and portions of the Biscayne pineland not previously traversed by the writer were examined.

A week was devoted to further exploration in the Cape Sable region. Only new localities were visited. We had planned to revisit the Cuthbert Lake and the Coot Bay regions, but a strong easterly wind had blown most of the water out of the Bay of Florida east of Flamingo and recent rains had filled the sloughs on the mainland north of Flamingo and had made them impassable. Consequently, our plans were frustrated by too little water in the sea and too much water on the land.

Although a continued strong easterly wind had perceptibly lowered the water in the bay, we sailed without difficulty as far east as Joe Kemp's Key, where we anchored. There leaving the "Barbee" we went ashore on the key. This was the first time botanists had set foot on the island, and I might say in passing that there are over a hundred Florida Keys upon which collectors have not yet set foot, and what strange plants may be hidden in their hammocks we do not know!

We spent the forenoon collecting on the sand-dunes of the key and in its hammocks, as well as in the hammocks of the adjacent mainland. The wind increased in velocity and we noticed that the water in the bay was rapidly getting lower. We then made haste to go to the "Barbee," which we managed to reach with difficulty, for when we approached her she was resting high and dry on the soft mud bottom of the bay.

This condition of low water afforded an unusual opportunity for collecting the kinds of aquatic flowering plants that grow only on the bottom of the bay. Three kinds were present there, the turtle-grass, the manatee-grass, and a third kind quite similar to the manatee-grass in habit, but with flat leaves. Previously, this plant was apparently one of the very rare plants in our



In hammock on Roberts Island in Everglades west of Little River, Fla. A strangling-fig, pale-barked tree, grappling a cocoa-plum, horizontal tree-trunk in front, and a swamp-bay, erect trunk behind. Note strongly buttressed trunk of strangling-fig.

flora and no definite locality for it was known. Our observations prove it to be exceedingly common. Its botanical name is *Halodule*. It has no common name, but it would ordinarily pass for manatee-grass, which it very closely resembles.

As the tide came in the wind abated slightly, and as soon as the "Barbee" floated we moved westward a few miles and sought shelter for the night behind a small cape. The velocity of the wind increased again, and at dusk we were compelled to drive a long stake through the anchor ring to keep from being blown out into the Gulf of Mexico.

After sunrise the next morning we went ashore at Flamingo and started westward across the prairie in the direction of Cape Sable. Between the Cape and the Flamingo region are extensive prairies almost as level as a floor, except for occasional "gator" holes. Hammocks are scattered here and there on the prairies. These, however, are more numerous toward the shore of the bay on the south and along the evidently lower parts of the prairie several miles toward the north. Strong winds sweep the prairies almost unceasingly.

We walked westward nearly to the East Cape, and along the course discovered a number of plants not before known in our flora except on the Florida Keys. The prairie region and adjacent parts are full of bird-life. There is much evidence of it in the hammocks, which often are large rookeries. Reptiles, too, are plentiful. Poisonous snakes are represented by moccasins in the low parts of the prairies and diamond-back rattlers about the hammocks. In a hammock midway between the Cape and Flamingo one member of our party serenely stepped over two "bell-cows," as the rattlesnakes are locally known in parts of Florida; but he was not aware of his daring feat until his attention was directed to the snakes by a companion walking behind him. The reptiles were each over six feet in length.

By sunset we had retraced our steps to Flamingo. During the day we had gathered a wagon load of living plants and herbarium specimens, all of which we transferred to the "Barbee." The following morning we began our homeward journey. We proceeded directly to Cape Sable and made a landing on each

of the three capes, where we examined new localities. At each cape we were rewarded by discovering plants new to our flora. After going northward to the boundary line separating Cape Sable and the Ten Thousand Islands, we boarded the "Barbee" and headed her toward Lower Matecumbe Key. We made a harbor on the inner side of this key after sunset and the following morning went ashore to hunt for plants in parts of the hammock which had not before been visited. The most interesting plant encountered was a rare cactus with simple or nearly simple stems often growing between twenty and thirty feet tall.

After starting on another tangent of our homeward journey late in the afternoon, we decided to visit Madeira Bay. Night fell before we reached Pigeon Key, at which point one must turn north in order to reach Madeira Bay. As a matter of saving time for field-work we determined to attempt to cover the course in the dark. We dodged islands by keeping a sharp lookout and missed running aground on sand-bars by mere luck. All went well and before midnight we anchored at what we unanimously decided was the entrance to Madeira Bay. The next morning at sunrise the outlook seemed quite different and we sighted the entrance to the bay about a half a mile eastward from where we lay. Our collections in and about Madeira Hammock added more plants to our flora. The same afternoon we started on the final portion of our homeward journey, and reached our destination late in the evening of the same day.

All the field-work described and accomplished, which made possible the many interesting discoveries, was due to the interest of Mr. Charles Deering.

The results of the exploration may be stated as follows: first, a number of plants, representing chiefly liverworts, mosses, ferns, and flowering plants, either new to science or new to the flora of the United States; second, additions to our list of plants growing naturally in the Everglades, a descriptive flora of which is contemplated; third, further information on the geographical distribution of the plants of southern, particularly tropical, Florida; fourth, much information on the physiography of south-

ern Florida which will be recorded in a subsequent paper; fifth the collection and preservation of the rarer native plants from localities that are rapidly changing or disappearing, for our herbarium, and for distribution to other herbaria, and the transplanting of living specimens to reservations, where they will be preserved from destruction.

Respectfully submitted,

JOHN K. SMALL.

HARDY WOODY PLANTS IN THE NEW YORK BOTANICAL GARDEN

(Continued)

Picea pungens. COLORADO SPRUCE.

Location: Pinetum, knoll northwest of Conservatory Range 1.

Natural distribution: Wyoming to New Mexico.

Picea pungens var: **glauca.** BLUE COLORADO SPRUCE.

Location: Pinetum, with the above; also at Fountain Enclosure.

West end of Long Bridge. Woodlawn Road Bridge.

Picea pungens var: **glauca pendula.** WEEPING COLORADO BLUE SPRUCE.

Location: Pinetum, near Fountain Enclosure.

Picea pungens var: **Kosteri.** KOSTER'S BLUE SPRUCE.

Location: Pinetum, knoll northwest of Conservatory Range 1;
also at Fountain Enclosure. Woodlawn Road Bridge.

Picea pungens var: **Kosteri compacta.** KOSTER'S DENSE-LEAVED SPRUCE.

Location: Pinetum, northwest of Conservatory Range 1.

Picea Schrenkiana. SCHRENK'S SPRUCE.

Location: Pinetum, along west border south of Station Plaza
near Hydrangea group.

Natural distribution: Siberia to northern China.

Picea Smithiana. SMITH'S SPRUCE.

Location: Pinetum, with the above.

Natural distribution: Himalayan Region.

Picea jezoensis (*P. ajanensis*). YESSO SPRUCE.

Location: Pinetum, with the above. West end of Long Bridge in low land.

Natural distribution: Japan.

Tsuga. HEMLOCKS

Tsuga canadensis. HEMLOCK.

Location: Pinetum, along West Border, south of Power House I.
Hemlock Forest, along Bronx River.

Natural distribution: Eastern North America.

Tsuga canadensis var: albo-spica. SILVERY-SPOTTED HEMLOCK.

Location: Pinetum, with the above.

Tsuga canadensis var: compacta. DENSE HEMLOCK.

Location: Pinetum, with the above.

Tsuga canadensis var: gracilis. SLENDER HEMLOCK.

Location: Pinetum, with the above.

Tsuga canadensis var: parvifolia. SMALL-LEAVED HEMLOCK.

Location: Pinetum, with the above.

Tsuga canadensis var: pendula. WEEPING HEMLOCK.

Location: Pinetum, with the above. West end of Long Bridge. Iris Garden. Flower beds at Conservatory Range I.

Tsuga caroliniana. CAROLINA or CRAG HEMLOCK.

Location: Pinetum, with the above.

Natural distribution: Virginia to Georgia.

Tsuga diversifolia. HAIRY-TWIGGED JAPANESE HEMLOCK.

Location: Pinetum, with the above.

Natural distribution: Japan.

Tsuga Tsuga (*T. Sieboldii*). SIEBOLD'S HEMLOCK.

Location: Pinetum, with the above. Flower beds at Conservatory Range I.

Natural distribution: Japan.

Pseudotsuga. DOUGLAS SPRUCE

Pseudotsuga mucronata (*P. Douglasii*). DOUGLAS SPRUCE.

Location: Pinetum, west side, between path and driveway and also between the driveways, near approach to elevated

railroad. West end of Long Bridge. Group at foot of Museum Approach.

Natural distribution: Western North America.

Pseudotsuga mucronata var: **glauca**. BLUE DOUGLAS SPRUCE.

Location: Pinetum, with the above between driveways.

Abies. FIRS

Abies amabilis. RED SILVER FIR.

Location: Pinetum, near flower border at approach to elevated railway.

Natural distribution: Northwestern North America.

Abies balsamea. BALSAM FIR.

Location: Pinetum, northwest of Conservatory Range 1; in depression north of Power House 1.

Natural distribution: Northern North America.

Abies cephalonica. MT. ENOS FIR.

Location: Pinetum, northwest of Conservatory Range 1.

Natural distribution: Greece.

Abies cilicica. CILICIAN FIR.

Location: Pinetum, northwest of Conservatory Range 1.

Natural distribution: Asia Minor.

Abies concolor. WHITE FIR.

Location: Pinetum, northwest of Conservatory Range 1. Woodlawn Bridge. West end of Long Bridge.

Natural distribution: Western North America.

Abies concolor var: **falcata**. CURVED-LEAVED WHITE FIR.

Location: Pinetum, with the above.

Abies Fraseri. FRASER'S FIR.

Location: Pinetum, in depression north of Power House 1.

Natural distribution: Alleghany Mountains.

Abies grandis. GREAT SILVER FIR.

Location: Pinetum, near flower border at approach to elevated railway.

Abies homolepis. NIKKO SILVER FIR.

Location: Pinetum, northwest of Conservatory Range 1.

Natural distribution: Japan.

Abies homolepis var: *umbellata*. MAYR'S FIR.

Location: Pinetum, with the above.

Distribution: Japan.

Abies lasiocarpa. WESTERN BALSAM FIR.

Location: Pinetum, northwest of Conservatory Range 1; in depression north of Power House 1.

Natural distribution: Western North America.

Abies Momi (*A. firma*). JAPANESE SILVER FIR.

Location: Pinetum, west of Conservatory Range 1.

Natural distribution: Japan.

Abies nobilis. RED FIR.

Location: Pinetum, northwest of Conservatory Range 1.

Natural distribution: Washington and Oregon.

Abies Nordmanniana. NORDMANN'S SILVER FIR.

Location: Pinetum, northwest of Conservatory Range 1.

West end of Long Bridge. Woodlawn Bridge.

Natural distribution: Caucasus.

Abies numidica. ALGERIAN SILVER FIR.

Location: Pinetum, northwest of Conservatory Range 1.

Natural distribution: Northern Africa.

Abies Picea (*A. pectinata*). SILVER FIR.

Location: Pinetum, northwest of Conservatory Range 1; in depression north of Power House 1.

Abies Pinsapo. SPANISH FIR.

Location: Pinetum, in depression north of Power House 1.

Natural distribution: Spain.

Abies sibirica. SIBERIAN FIR.

Location: Pinetum, in depression north of Power House 1.

Natural distribution: Northern Europe and Asia.

Abies Tomomi. TOMOMI FIR.

Location: Pinetum, northwest of Conservatory Range 1; near flower bed at approach to elevated railway.

Natural distribution: Japan.

Abies Veitchii. VEITCH'S SILVER FIR.

Location: Pinetum, northwest of Conservatory Range 1; also between path and driveway.

Natural distribution: Japan and Manchuria.

TAXODIINAE. *Taxodium* Tribe**Sciadopitys.** UMBRELLA PINE**Sciadopitys verticillata.** UMBRELLA PINE.

Location: Pinetum, north end of Herbaceous Grounds valley.

Natural distribution: Japan.

Sequoia. SEQUOIAS**Sequoia Washingtoniana.** BIG TREE.

Location: Pinetum, north end of Herbaceous Grounds valley.

Natural distribution: Sierra Nevada Mountains, California.

PLANTING THE NEW ROSE GARDEN

The plans for the Rose Garden, designed by Mrs. Beatrix Farrand in cooperation with Mr. John R. Brinley, Landscape Engineer of the New York Botanical Garden, were described and illustrated in the issue of the *Journal* for August, 1916, where a record of the commencement of work was made by the breaking of ground on May 4, 1916. The construction of the garden has since been continuously prosecuted by the aid of a special fund subscribed by 107 members of the Garden.* To this fund the sum of \$100 has since been added by Mrs. Marin Le Brun Cooper.

During the season of 1916, most of the grading, drainage, and path building was accomplished, including the hauling of top-soil to an average thickness of $2\frac{1}{2}$ feet over the whole area of about an acre and a quarter, except the portions occupied by paths; this top-soil was obtained by stripping path locations elsewhere on the grounds, thus accomplishing two purposes at once. During the winter and early spring, a considerable amount of rock was excavated at the northwestern corner of the Garden, and all used in the construction of paths. Some work has also been done in grading the immediate surroundings of the garden and the system of path approaches, and this is still in progress.

* See Bulletin, N. Y. Bot. Garden 9: 371-373.

About 5,000 rose plants have been contributed to the Garden through the Horticultural Society of New York, and planting was commenced on April 23, 1917. On Thursday, April 26, 1917, a conference was held at the Mansion by members of the Garden Board of Managers and Women's Auxiliary and members of the Council of the Horticultural Society, relative to the further development of the Garden, on which occasion Mrs. Farrand lectured on "Roses and the New Rose Garden" and Mr. John Woodcock, of Ossining, New York, made supplementary remarks relative to the care and cultivation of roses. Mrs. Farrand's designs for the central arbor and trellis enclosure of the garden were exhibited and described at this time. It is hoped that some friend or friends of the Garden will contribute the sums necessary for the construction of these architectural features.

CONFERENCE NOTES

The April conference of the Scientific Staff and Registered Students of the Garden was held in the general laboratory of the museum building on the afternoon of April 4.

At this conference two reports of investigations were presented as follows:

"Studies of North American species of *Phyllachora*," by Professor C. R. Orton.

The genus *Phyllachora* was described in Symb. Myc. 216. 1869, and based on *Sphaeria graminis* Pers. Obs. Myc. 18. 1796, where this fungus was not only described but illustrated as well.

The present study has been undertaken for the purpose of presenting descriptions of the species of this genus which occur in North America. About 25 species have been described in the past from North American material, but only a part of these are now referable to this genus. Several South American species are found in tropical North America and some European species have been established.

Morphological studies are being carried along with the taxonomic work as well as cytological investigations. Cultural work is also being pursued in order to definitely work out the life history of these forms, regarding which so little is known.

Cytological preparations showing various stages of the development of the ascus in this species were exhibited at the conference.

"The cultivation of *Hevea* with respect to the production of rubber," was presented by Professor Henri Hus.

During the past two years Dr. Hus has spent all of his time in the investigation of *Hevea*. Much of this time has been spent in the rubber-tree plantations of Java, Sumatra and the Federated Malay states. For several months Dr. Hus has been at the New York Botanical Garden working over data and material.

Dr. Hus presented to the conference on account of the introduction of *Hevea* into the East and the development of the rubber industry that followed. Methods of cultivation and tapping were described and a general report was made of the variability in the yield of dry rubber.

Numerous specimens and photographs were exhibited to illustrate and demonstrate various points.

A. B. STOUT,
Secretary of the Conference

NOTES, NEWS AND COMMENT

The following persons enrolled in the library during April as investigators at the Garden: Hermann W. Merkel, New York, N. Y.; Professor Francis E. Lloyd, Montreal, Canada; Professor L. H. Pennington, Syracuse, N. Y.; Professor H. S. Jackson, Lafayette, Ind.; Professor H. H. Whetzel, Ithaca, N. Y.; Dr. C. L. Shear, Washington, D. C.; Mrs. Frank E. Lowe, Worcester, Mass.; Felix G. Quero, and Dr. J. Lopez-Suarez, Madrid, Spain.

About seventy-five members of the Department of Botany of the Brooklyn Institute of Arts and Sciences held a spring field meeting at the New York Botanical Garden on the afternoon of Saturday, April 28, when they were conducted through the public conservatories and portions of the grounds by Dr. W. A. Murrill, Dr. F. J. Seaver, Mr. Percy Wilson, and Miss Helene Boas. At four o'clock, they assembled in the lecture hall to hear Dr. N. L. Britton speak on "Early Spring Flowers."

Volume 10, part 2, of *North American Flora*, by Dr. W. A. Murrill, appeared April 26. This part contains descriptions of 282 species of rosy-spored gill fungi, 107 of which are new.

Dr. Walter Mendelson has recently given an interesting collection of herbarium specimens to the Garden. These were collected mostly in the vicinity of Germantown, Pennsylvania, and will be added to the local flora herbarium.

A number of specimens of the rarer plants of the vicinity of New York, collected during last season by members of the Garden staff, have been mounted and incorporated in the local flora herbarium.

The Garden has recently received a collection of one hundred and fifty specimens of cup fungi from Professor C. G. Lloyd for determination and study. The collection represents the accumulation of several years and is of considerable value in connection with the study of this group for *North American Flora*.

Professor H. S. Jackson of the Indiana Experiment Station recently spent several days at the Garden in continuation of his work on certain groups of plant rusts.

Professor C. G. Lloyd recently spent several days at the Garden studying the collections of woody fungi.

Professor H. H. Whetzel of Cornell University spent several days in the library looking over phytopathological literature.

The last few days of April brought out some of the magnolias in the new collections of these plants in the Arboretum. The first to bloom was *Magnolia denudata*, the Yulan. This large-flowered kind is a native of China, and its white flowers are very fragrant.

At Conservatory Range 2, a fine plant of *Posoqueria longiflora* is in bloom. Its clusters of tubular waxy flowers are pure white in color, fragrant, and decidedly attractive.

Meteorology for April.—The total precipitation for the month was 1.68 inches. Maximum temperatures recorded for each week were as follows: 84° on the 1st, 64° on the 11th, 75° on the 22d, and 78° on the 23d. The minimum temperatures were 27° on the 9th, 31° on the 15th and 17th, and 35° on the 25th.

ACCESSIONS

PLANTS AND SEEDS

2 plants for Conservatories. (By exchange with U. S. National Museum, through Dr. J. N. Rose.)

234 plants for Nurseries and Conservatories. (By exchange with U. S. Dept. of Agriculture, Bureau of Plant Industry.)

24 plants for Nurseries. (Collected by K. R. Boynton.)

118 plants for Fruticetum and Arboretum. (Purchased.)

799 South American cacti for Conservatories. (Collected by Dr. J. A. Shafer.)

35 plants for Conservatories. (Collected by Dr. A. Lofgren.)

118 plants derived from seed from various sources.

6 packets of seeds. (Given by Mr. E. B. Williamson.)

LIBRARY ACCESSIONS FROM MARCH 1 TO APRIL 30, 1917.

AMPHLETT, JOHN, & REA, CARLETON, *The botany of Worcestershire . . . the mosses and hepatics contributed by J. E. Bagnall.* Birmingham, 1909.

BAILEY, LIBERTY HYDE. *The standard cyclopedia of horticulture.* Vol. 6. New York, 1917.

BRIDGEMAN, THOMAS. *The florist's guide.* New and improved edition. New York, 1844. (Given by Dr. J. H. Barnhart.)

CHEVALIER, AUGUSTI. *Sudania: énumération des plantes récoltées en Afrique tropicale par M. Aug. Chevalier de 1898 à 1910 inclus.* Vol. 1. Paris, 1911.

COOPER, J. W. *The experienced botanist or Indian physician.* Lancaster, 1840. (Given by Dr. J. H. Barnhart.)

CORREVON, HENRY. *Atlas de la flore alpine.* 5 (6) vols. Genève & Bale, 1899.

DORSTEN, THEODORE. *Botanicon, continens herbarum, aliorumque simplicium, quorum usus in medicinis est, descriptiones . . .* Francforti, 1540.

DUPPA, RICHARD. *The classes and orders of the Linnaean system of botany.* 3 vols. London, 1816.

HARTIG, ROBERT. *Lehrbuch der Baumkrankheiten.* Berlin, 1882.

HASSARD, ANNIE. *Floral decorations for the dwelling house.* London, 1876.

JOHNSON, GEORGE WILLIAM. *The gardeners' dictionary.* London, 1890. (Given by Dr. J. H. Barnhart.)

KNY, CARL IGNAZ LEOPOLD. *Ueber das Dickenwachsthum des Holzkoerpers in seiner Abhaengigkeit von aeusseren Einflussen.* Berlin, 1882.

LEHMANN, JOHANN GEORG CHRISTIAN. *Icones et descriptiones novarum et minus cognitarum stirpium.* Pars 1. Hamburgi, 1821.

MCCOLLAM, WILLIAM C. *Vines and how to grow them.* Garden City, 1911 (Given by Dr. J. H. Barnhart.)

MACVIVAR, SYMERS MACDONALD. *The student's handbook of British hepatics . . . with illustrations by H. G. Jameson.* London, 1912.

OSGOOD, FRANCES SARGENT (LOCHE). *The poetry of flowers and flowers of poetry.* New York, 1851. Another edition, New York, 1853. (Given by Dr. J. H. Barnhart.)

PENHALLOW, DAVID PEARCE. *A manual of the North American gymnosperms.* Boston, 1907.

Phantom flowers; a treatise on the art of producing skeleton leaves. Boston, 1864. (Given by Dr. J. H. Barnhart.)

POWELL, ISAAC L. *Chrysanthemums and how to grow them.* Garden City, 1911 (Given by Dr. J. H. Barnhart.)

PRATT, MARA L. *The fairyland of flowers.* Boston, 1890. (Given by Dr. J. H. Barnhart.)

PRICE, SARAH. *Illustrations of the fungi of our field and woods.* 2 vols. London, 1864-65.

RANDOLPH, CORNELIA J. *The parlor gardener.* Boston, 1881. (Given by Dr. J. H. Barnhart.)

ROSSMÄSSLER, EMIL ADOLPH. *Der Wald.* Ed. 3. Leipzig & Heidelberg, 1881.

SCHENCK, PETER ADAM. *The gardener's text-book.* Boston, 1851. (Given by Dr. J. H. Barnhart.)

The annals of Scottish natural history. Vol. 1-19, Edinburgh, 1892-1910.

TWINING, ELIZABETH. *Illustrations of the natural orders of plants.* 2 vols. London, 1868.

WATSON, WILLIAM, & BEAN, WILLIAM JACKSON. *Orchids: their culture and management.* London, 1890.

WIESNER, JULIUS VON. *Die Rohstoffe des Pflanzenreiches.* Leipzig, 1873.

WILLIAM, BENJAMIN SAMUELS. *The orchid-growers' manual, containing descriptions of . . . orchidaceous plants in cultivation.* Ed. 7, enlarged and revised . . . by Henry Williams. 2 vols. London, 1894.

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Vol. 7, part 1, 1906; part 2, 1907; part 3, 1912. Ustilaginaceae—Aecidiaceae (pars).

Vol. 9 (now complete), parts 1 and 2, 1907; part 3, 1910; part 4, 1915; parts 5, 6, and 7, 1916. Polyporaceae—Agaricaceae (pars). (Parts 1 and 2 no longer sold separately.)

Vol. 10, part 1, 1914; parts 2 and 3, 1917; part 3, 1917. Agaricaceae (pars).

Vol. 15, parts 1 and 2, 1913. Sphagnaceae—Leucobryaceae.

Vol. 16, part 1, 1909. Ophioglossaceae—Cyatheaceae (pars).

Vol. 17, part 1, 1909; part 2, 1912; part 3, 1915. Typhaceae—Poaceae (pars).

Vol. 21, part 1, 1916; part 2, 1917. Chenopodiaceae.

Vol. 22, parts 1 and 2, 1905; parts 3 and 4, 1908; part 5, 1913. Podostemonaceae—Rosaceae (pars).

Vol. 25, part 1, 1907; part 2, 1910; part 3, 1911. Geraniaceae—Burseraceae.

Vol. 29, part 1, 1914. Clethraceae—Ericaceae.

Vol. 34, part 1, 1914; part 2, 1915; part 3, 1916. Carduaceae—Anthemideae.

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Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 278 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of the New York Botanical Garden. viii + 592 pp., with 43 plates and many text figures. 1916.

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Head Gardener's Assistant



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